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ABSTRACT

Five simulations for addressing science-related social issues in either the secondary science or social studies classroom are presented. Following a foreword, introduction, and description of the conceptual basis for the activities, each of the activities is presented in its entirety. Complete teacher and student materials for conducting each of the following simulations is presented: storage of spent nuclear fuel, control of recombinant DNA, the acid rain controversy, toxic waste controls, and the controversy over seabed mining. Each simulation follows a standard format emphasizing student skills of information processing, problem solving and group decision making. Students are divided into groups representing a decision-making body and pro, con, and compromise positions on a given issue. Students research their position using provided data and library resources, ultimately using their findings to support their group's position in a simulated public or agency hearing on the subject. Each activity contains step-by-step instructions and student handouts. Each simulation takes approximately two weeks. (LP)

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CREATIVE ROLE-PLAYING EXERCISES IN
SCIENCE AND TECHNOLOGY

Compiled and Edited by Lynn Parisi

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TABLE OF CONTENTS

Foreword.. iv

Acknowledgements v

Introduction 1

Conceptual Basis for CREST Activities 3

Activity 1: Hot Rods: Storage of Spent Nuclear Fuel 9
    Handouts.. 21
    Role Cards.. 81

Activity 2: Designer Genes: Control of Recombinant DNA Research ... 143
    Handouts.. 157
    Role Cards.. 205

Activity 3: Rainy Day Blues: The Acid Rain Controversy 265
    Handouts.. 277
    Role Cards.. 345

Activity 4: 30,000 Barrels of Goo: Toxic Waste Controls 405
    Handouts.. 419
    Data Cards.. 457
    Role Cards.. 543

Activity 5: Finders Keepers: The Controversy over Seabed Mining ... 603
    Handouts.. 617
    Role Cards.. 681

Additional Resources 735

FOREWORD

This book is one of the many publications of the ERIC Clearinghouse for Social Studies/Social Science Education and of the ERIC system to show practical ways in which the rich bibliographic resources of our nation, and especially those of the ERIC system, can be used in the creation of socially relevant and up-to-date teaching materials.

The background and purposes of this particular publication are ably explained in the editor's introduction, in which an eloquent plea is made for better education in the many social problems posed by the rapid development of science and technology. It is our hope that the teaching materials presented here will be useful in themselves and will also serve as an example of how teachers and curriculum developers can use current data to construct other timely materials.

Irving Morrissett
Director, ERIC Clearinghouse for
Social Studies/Social Science
Education, and
Executive Director, Social Science
Education Consortium, Inc.

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The activities in this publication were originally developed as part of a three-year curriculum project conducted by the Social Science Education Consortium, Inc., between 1980 and 1983, with funding from the National Science Foundation. Bruce Tipple, John Zola, Douglas Superka, Kenneth Switzer, and Sharryl Davis Hawke, formerly staff associates with SSEC, developed the original lessons.

For their assistance in completing the published version of these materials, appreciation is due to John Zola for reviewing revised and adapted activities; Cindy Cook for assembling the reproduction copy; Marcia Hutson for copy editing; and Janet Hagood for her care in typing the final manuscript.

Lynn Parisi

INTRODUCTION

Public perceptions of science and technology have undergone significant change over the past few decades. Fifty years ago, science was considered an activity confined to laboratories and research institutions; technology tended to be equated with progress. Increasingly, however, science and technology are becoming social issues. Developments in electronics, biology, and medicine have effected changes in many aspects of political, economic, and social life. The far-reaching impact of technology has caused scientists, government officials, and citizens to voice concern over such issues as resource depletion, environmental pollution, production of toxic wastes, and biomedical ethics and controls.

Today's citizens are not only affected by science-based developments, they are increasingly called upon, through their participation in the democratic political process, to affect public policy concerning the development and application of science and technology. The public policy agenda at all levels is filled with issues generated by advances in science and the application of these advances through technology. On one level, citizens must elect government representatives charged with the responsibility of deciding national issues such as nuclear weapons research and production, energy policy, land use policy, and resource development. In addition, the American people are called upon to vote directly on local and state issues with complex science or technology components. Such issues as transport of hazardous chemicals along Colorado highways, toxic waste dump sitings in Nevada, and field testing of artificially created bacteria on California farms are among those decided locally and statewide through public initiatives and referenda. Lay citizens affect public policy through citizen advisory boards, public meetings and hearings, and public information centers. Increasingly, federal agencies have been required by Congressional mandate to involve citizens directly in the formulation and implementation of science and technology policies. The Airport and Airways Development Act, Federal Water Pollution Control Act, Coastal Zone Management Act, and National Environmental Policy Act are among the laws including such mandates.

It is clear that issues such as those cited above have seriously complicated and challenged citizen participation in policy making. Informed and intelligent citizen participation in such issues increasingly requires three things: (1) a knowledge of technical and scientific facts; (2) an ability to recognize the interface between science and society--that is, to recognize the real and potential impact of science and technology on social, economic, and political conditions; and (3) decision making skill--the ability to synthesize and process all this information in a systematic and rational way.

The five activities in this publication were developed to help prepare students for participation as informed and interested citizens in the making or enforcement of public policy related to science and technology. Each activity focuses on a contemporary science-related issue and integrates the presentation of scientific and societal data with a risk assessment and decision-making exercise. All five activities follow a standard procedure: students are divided into groups representing a decision-making body and pro, con, and compromise positions on a given issue. Students research their positions using provided data and library resources, ultimately using their findings to support their group's position in a simulated public or agency hearing on the subject.

The activities are presented in a uniform format. Each begins with a brief introduction followed by a list of objectives. Time and material needed to complete the activity are suggested. Finally, step-by-step instructions are provided. Black-line masters for student handouts follow these instructions. The book concludes with a list of additional resources, including a selection of resources from the Educational Resources Information Center (ERIC) system.

Earlier versions of the Creative Role Playing Exercises in Science and Technology (CREST) were developed between 1980 and 1983 as part of a curriculum project conducted by the Social Science Education Consortium, Inc. That project was made possible by a grant from the National Science Foundation. All exercises have been updated and revised for this publication.

CONCEPTUAL BASIS FOR CREATIVE ROLE-PLAYING EXERCISES IN SCIENCE AND TECHNOLOGY (CREST)

Creative Role-Playing Exercises in Science and Technology (CREST) focus on science-related social issues of concern in contemporary public policy formation. The exercises are designed to help students develop information-processing and decision-making skills needed to deal effectively with such issues.

Several major concepts--science, technology, conflict, values, costs, benefits, and public policy--and two important skills--risk assessment and decision making--guided the development of these exercises. This brief introduction elucidates the importance and interrelationship of these concepts and skills, both for the development of the CREST activities and for effective classroom use of these materials.

Each CREST activity guides students in analyzing an important science-related social issue by applying the concepts of SCIENCE, TECHNOLOGY, CONFLICT, VALUES, RISKS, COSTS, BENEFITS, DECISIONS, and PUBLIC POLICY.

Human society is obviously the general forum for the issues considered in CREST. Yet it is important to remember that human society exists as part of a natural system in which complex physical, chemical, and biological processes interact. SCIENCE is the means by which the natural system--including human society--is understood. George C. Homans has written this explanation.

> Any science has two main jobs to do: discovery and explanation. By the first we judge whether it is a science, by the second, how successful a science it is. Discovery is the job of stating and testing more or less general relationships between properties of nature....Explanation of a finding, whether a generalization or a proposition about a single event, is the process of showing that the finding follows as a logical conclusion, as a deduction, from one or more general propositions under specified given conditions.[1]

Science, then, has helped humans understand more clearly how physical, chemical, biological, and social processes work. It has also enabled human society to be less immediately dependent on nature; fewer and fewer humans interact directly with nature for their livelihood. This interaction is mediated by complex social systems and technology.

TECHNOLOGY modifies and magnifies human impact on nature by extending human energy. In turn, natural influences are, to some degree, controlled and altered through the application of technology. Technology is embodied in ideas as well as physical artifacts, and encompasses tools as simple as stone scrapers and as complex as nuclear power plants. Its many forms include instruments, containers, machines, and facilities.

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1. Homans, George C., The Nature of Social Science. New York: Harcourt, Brace, and World, Inc., 1967, p. 7, 23.

Science and technology complement each other. Science leads to clearer understanding of natural processes, which in turn leads to more effective manipulation of nature. This manipulation opens avenues for further exploration, discovery, and explanation.

Since technology has increased specialization and division of labor, every individual has become more dependent on the work of other individuals. Each individual's economic role is tied directly and indirectly to a large number of others; it accounts for only one step toward providing needed goods and services. This means that the productive process is more susceptible to disruptive social forces--for example, a strike by transportation workers. As a result, technology has brought about a greater need for rules, regulations, and laws. Philip Wagner explained the relationship between applied technology and increased regulation as follows:

> Through ingenuity and effort, man's technical and economic institutions mediate between the raw environment and human life, but this less immediate dependency is only complementary, not opposite, to ultimate dependence upon nature. The strategy that so releases man from simple and immediate dependence upon the moods of nature rests completely upon planned and organized behavior. The price of liberation from direct dependence on the natural environment is subjection to societal regulation.[2]

Much is yet to be learned about technology and its impact on nature and society. Questions about the long-term effects of technological systems must be given serious consideration, as must questions about the ability of the natural systems to withstand, absorb, and/or recover from these effects.

The potential for the occurrence of an event with negative consequences--the RISK--is increasingly the focus of CONFLICT over technology. Such conflict occurs between individuals, groups, and organizations who differ in their assessment of the risks, COSTS, and BENEFITS of a given application of technology. These perceptions are strongly influenced by the backgrounds, experiences, education, and VALUES of the parties involved in the conflict. Several additional factors may contribute to or heighten such conflict. Private interests often seem to be in opposition to public interests. Among the questions most vehemently argued are those concerning who derives the benefits from the technology and who bears the costs and faces the risks. Determining an "acceptable" level of risk may also contribute to the conflict.

Thus, both the conflicts over technology and the need for cooperation stemming from its use stimulate the making of PUBLIC POLICY--general decisions which "prescribe ways of handling a 'family' of situations."[3] To be truly effective, such policies (regulations) must be complemented by enforcement efforts. CREST activities focus on both the making and enforcement of public policy.

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[2] Wagner, Philip. The Human Use of the Earth. New York: The Free Press of Glencoe, 1970, p. 62-63.

In both making and enforcing public policies related to technological issues, a major goal is to manage risk. Risk management is a complex discipline which, for purposes of simplicity, we have broken down into four major steps: (1) defining (analyzing) the risk, (2) identifying alternative courses of action, (3) analyzing the costs and benefits of each alternative, and (4) selecting a course of action. These four steps are integrated into CREST simulations as follows.

A problem situation or decision occasion--for example, the proposed building of a nuclear power plant--establishes the conditions to be considered. Students first conduct an analysis of the risks implied by these conditions. This analysis typically centers on three major questions:

--What are the potential adverse effects associated with these conditions?

--What is the magnitude of these adverse effects?

--What are the probabilities that these adverse effects will occur?

The adverse effects may be defined in terms of their imminence, reversibility, and distribution. Attention is also paid to who will be exposed to these effects, whether this exposure is voluntary or involuntary, if effects are incremental, and the way in which these effects are perceived by different individuals and groups. The magnitude of the effects may be measured in terms of the health and safety (both physical and psychological) of human beings, the degradation of the environment or depletion of resources, the costs in dollars, or a combination of these. Computing the probabilities of these effects occurring is often extremely difficult because comparative data is lacking. For example, there has never been a meltdown of a nuclear reactor; but does that mean that the probability of such a meltdown is zero?

With this analysis of risks completed, the next step is to identify alternative courses of action. For purposes of CREST simulations, student groups represent extreme arguments and a compromise position between the extremes. Each group outlines the costs and benefits of the alternatives, which are then carefully weighed in a simulated public hearing. Of course, the importance assigned to each factor considered will vary from individual to individual. Costs may be measured in dollar value, loss of opportunity, physical damage, and a number of other ways. Benefits may be measured in increased economic opportunities, decreased risks, growing profits, and a host of other factors. The assessments of the costs and benefits of each alternative are filtered through the values of the decision maker, and a course of action is selected. The process may be graphically represented as shown on the following page.

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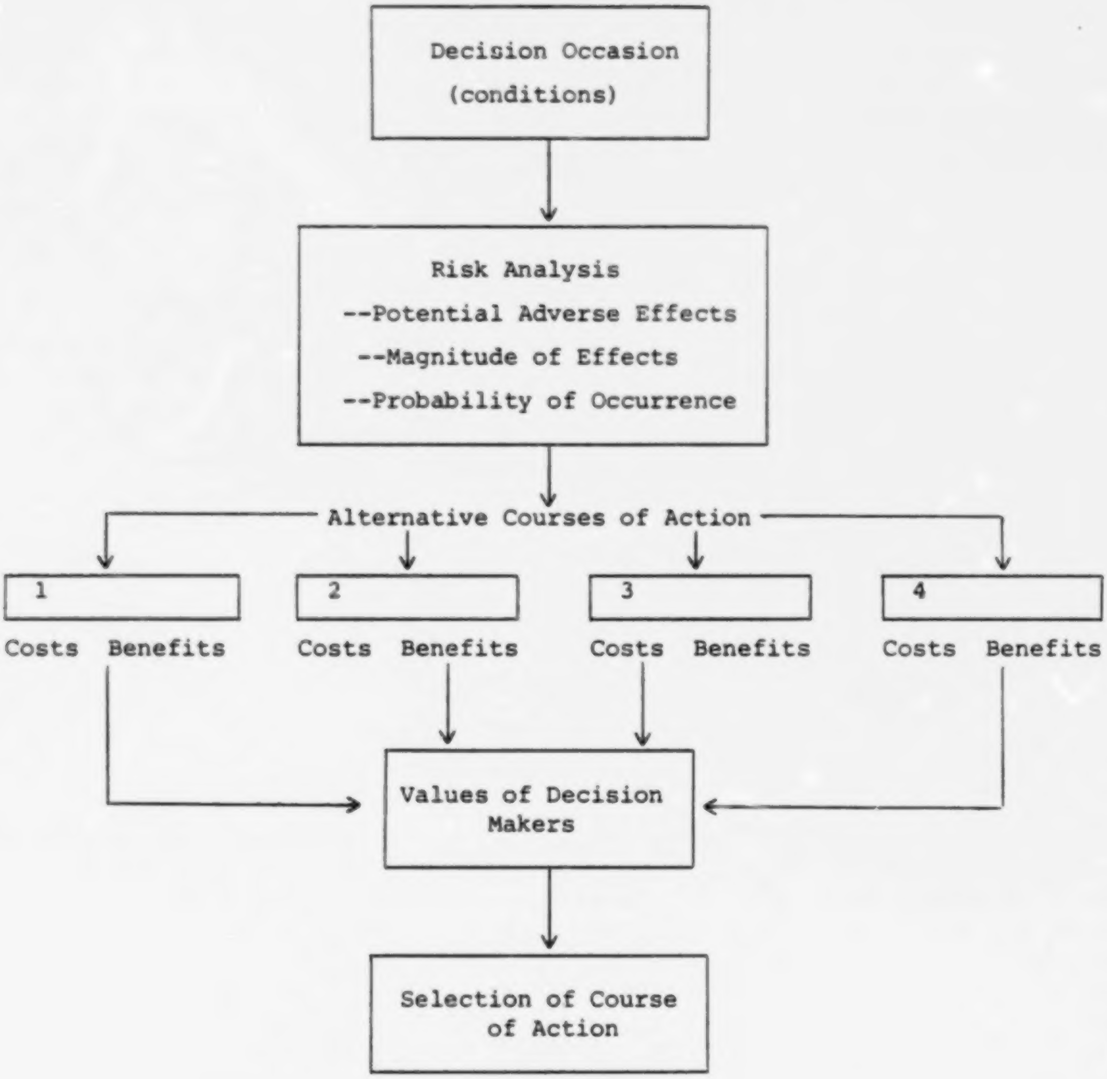
[3] Benne, Kenneth D., and Max Birnbaum. Teaching and Learning About Science and Social Policy. Boulder, CO: ERIC Clearinghouse for Social Studies/Social Science Education and Social Science Education Consortium, Inc., 1978.

This risk management process, then, should aid in the resolution of conflicts related to technological issues and facilitate the DECISION-MAKING process which can also be defined by a number of steps. Several models of the decision-making process are available. The model employed in CREST activities is not unique, but it provides direction and is readily understood. It also closely parallels the risk management model presented below.

RISK MANAGEMENT


Decision Occasion
(conditions)
Risk Analysis
--Potential Adverse Effects
--Magnitude of Effects
--Probability of Occurrence
Alternative Courses of Action
1
2
3
4
Costs Benefits
Costs Benefits
Costs Benefits
Costs Benefits
Values of Decision Makers
Selection of Course of Action

The model includes the following steps.

1. Carefully defining the issue or problem to be considered. (Risk analysis can be helpful in this step.)

2. Recognizing the interests and values of different individuals, groups, and/or organizations concerned with the issue or problem.

3. Identifying alternative courses of action (as in risk management).

4. Locating and using relevant information.

5. Identifying and analyzing the probable consequences of each alternative. (Cost/benefit analysis is useful for this purpose.)

6. Selecting an appropriate course of action.

7. Evaluating the course of action once implemented.

A word of caution is appropriate here. While these steps appear to form a linear process, in reality they do not. Locating and using information is, for example, important in each of the other steps. Furthermore, new or additional alternative courses of action may be recommended after others have been carefully analyzed.

Each case considered in the CREST activities contains ample opportunities for teachers and students to explore these important concepts and sharpen risk management and decision-making skills

ACTIVITY 1

HOT RODS: STORAGE OF SPENT NUCLEAR FUEL

OVERVIEW:

This role-play activity considers the debate over expansion of spent-fuel storage capacity at a nuclear power plant. The case is based on an actual controversy in Red Wing, Minnesota (1979), but has been relocated in the fictional community of Riverton in the state of Parkland.

Students are assigned roles representing Parkland hearing examiners, Acme Electric employees, scientists, government officials, Riverton residents holding various views regarding the proposed expansion, and other interested individuals. The students participate in a simulated state energy agency hearing to present arguments related to the pros and cons of the proposed expansion. In the actual hearing, examiners considered several alternative courses of action:

--Allow the expansion as proposed by Acme Electric Power Company.

--Allow a smaller expansion.

--Allow expansion for only a limited time.

--Have Acme build a new storage pool or pools.

--Have Acme enlarge the existing pool before allowing expansion of spent-fuel storage.

--Force Acme to close the power plant when its current spent-fuel storage capacity is reached.

For purposes of this simulation, the alternatives are narrowed to three major decisions--allow proposed expansion, reject further expansion, and allow compromise expansion.

Students are divided into groups representing each of the three positions on this issue and a decision-making group, the Parkland hearing examiners. Through several days of library and community research, the groups compile evidence to support their respective positions. To facilitate the research component of this activity, each group contributes the information they have compiled to a classroom resource center where all participants can obtain equal access to the information.

The culminating exercise for this activity is a public hearing, during which the three advocacy groups present their positions, supported by data they have collected, to the Parkland hearing examiners. Through analysis and questioning, the hearing examiners must reach a majority decision on the issue. A discussion analyzing the different viewpoints and the decision-making and risk management processes concludes the activity.

OBJECTIVES:

After participating in "Hot Rods," students will be better able to:

1. Explain and discuss the social, political, and economic factors that influence decisions made on public policy issues of science and technology (for example, short- and long-term employment, construction monies, taxes, and profits from new scientific advances).

2. Identify and describe the central conflict involved in a problem requiring social action and decision making.

3. Clearly state the interests and values involved in a problem situation.

4. Systematically analyze the risks in a problem situation and consider ways to minimize those risks. For example: What are the potential negative effects (risks)? Of what magnitude are the potential effects? What is the probability of the occurrence of these effects?

5. Identify or state alternative solutions to a problem situation.

6. Identify and analyze the probable consequences of particular courses of action.

GRADE LEVEL: 9-12

TIME: Approximately 7 class periods. The "Activity Timeline," Handout 1b, provides a schedule of activities.

MATERIALS: 30 role cards

Handouts. Reproduce as indicated.

1a: Background Notes: Nuclear Waste and the Maple Island Nuclear Generating Plant (1 per class member)
1b: Hot Rods Activity Timeline (1 per group)
1c: Instructions to Group Leaders (1 per group)
1d: Risk Assessment (1 per group)
1e: Press Release (1 for hearing examiners group)
1f: Hot Rods Group Worksheet (1 per advocacy group)
1g: Hearing Examiners Panel Group Worksheet (1 for hearing examiners group)
1h: Suggested Resources on Nuclear Energy (1 per class member)
1i: How to Run a Public Hearing (1 per hearing examiner)
1j: Maple Island Nuclear Reactor Data Packet (1 per group)

PROCEDURE:

Before beginning this activity, teachers and students should read Handout 1a, "Background Notes," on the controversy over expansion of spent-fuel storage at the Maple Island Power Plant. This information will be critical in providing you and your students the background needed to participate fully in the activity. Assign the "Notes" as a homework reading the day before the simulation is to begin.

Day 1: Introduction

A. To introduce the activity, brainstorm with students the pros and cons of nuclear power. Students should be able to come up with general pros and cons from their reading of "Background Notes." Ask students if there are nuclear plants in their state or region and what they know about them.

B. To insure that all students have a firm grasp of the facts of this simulation, compile a Maple Island Nuclear Plant fact sheet on the chalkboard. Much of the information for this fact sheet can come from the "Background Notes." The fact sheet should clarify, in the students' own words, what spent fuel is, how much is produced at the Maple Island reactor, why increased storage is necessary for the reactor to keep running, and so on.

C. Highlight the specifics of the role-play situation and introduce students to the decision-making steps outlined in the "Conceptual Basis for CREST" (pp. 3-7).

D. Assign each student a role and distribute role cards.* Names with initials may be played by males or females. Divide the class into the following four groups. Allow 10-15 minutes for participants to read their role cards and introduce themselves to their groups.

Hearing Examiners

P.E. Huber
C.J. Emory
J.D. Kelm
Brian Lasko
Marlene Sigal
Mark Povlock
Tracy Ono

Allow Proposed Expansion

Marie O'Shaughnessy
Tom Najarian
Donna Williams
Edward Quinn
N.A. Lowitz
O.P. Marek
M.L. Vosika
R.E. Barbeau

Reject Proposed Expansion

Patricia Morneau
Andrew Westphal
H.S. Stein
C.J. Sovich
T.W. Pohlman
M.I. Erickson
Maria Chavez
Clark Mara

Compromise Group

R.H. Hernandez
Y.C. Chu
Sam Renstrom
Sharryl Miller
Andrew Baden
M.S. Kinowski
Anna G. Jefferson

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*If the class has fewer than 30 students, the same relative size should be maintained for each group. The unused role cards should be added to the data compiled for that group since the information in them is important for the group to consider. In larger classes, students can work in pairs on single roles.

E. Distribute to each group a copy of Handout 1b, "Activity Timeline," and quickly review its contents. Identify one or two leaders for each group. They will be responsible for ensuring that their group attends to its tasks. Each group leader should receive a copy of Handout 1c, "Instructions to Group Leaders."

F. The initial group task is to begin to assess the risks involved in the proposed expansion of spent-fuel storage. Students should use information from the group members' role cards. The questions on Handout 1d, "Risk Assessment," should be used to guide discussion in each group.

G. (Optional). As homework, students should become completely comfortable with the information in their role cards. Teachers might assign students a re-reading of the background notes from the perspective of their role play.

Day 2: Preliminary Hearing and Intragroup Discussions

A. As a class, take 5 minutes to review the information compiled yesterday on Handout 1d, "Risk Assessment."

B. Using "Risk Assessment" as a guide, the hearing examiners group conducts a brief (approximately 15 minutes) preliminary class-wide hearing focused on the following major questions:

--What are the potential negative effects of the proposed expansion of spent-fuel storage at Maple Island?

--How extensive will these effects be?

--How likely is it that these effects will occur?

Be sure the hearing examiners understand that at this point everyone is operating with very little data. There will be some disagreement about the potential risks, especially the magnitude and the probability of their occurrence. In trying to assess the potential risks, the examiners might focus on the worst that could happen and identify the various positions on how likely it is that it will happen. More extensive discussion of the risks will take place during the activity's public hearing on Day 6.

C. Following the preliminary hearing, the hearing examiners prepare a news release on Handout 1e, "Press Release." This news release should be reproduced and distributed to the other groups.

After completing the news release, the hearing examiners group should begin to consider the alternative courses of action provided on Handout 1g, the "Hearing Examiners Panel Group Worksheet." The group should identify important questions related to each alternative for use in guiding the discussion during the public hearing.

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While the examiners group is preparing the news release, the other groups should complete Parts I and II of Handout 1f, "Hot Rods Group Worksheet." This is the first step in preparation for making presentations on their positions during the public hearing. As the groups begin work on the worksheet, they should identify their proposed courses of action and discuss reasons for their positions. The reasons should be listed in the left-hand column of the worksheet. Group leaders should see that each group member identifies at least one reason for that group's position. Careful reading of the role cards will facilitate this process.

The following are some of the key arguments that can be made by each of the three advocacy groups in "Hot Rods." Students can find many of these arguments set forth in the "Background Notes" and in their role cards. During research on Days 3 and 4, groups will seek specific supporting data for the arguments they choose.

Allow the Proposed Expansion

--Maple Island is needed to ensure that Acme can continue to meet demands for electricity and maintain a generation reserve for use in emergencies.

--The plant accounts for 30 percent of Acme's electric generating capacity.

--In three years there will no longer be enough space in the pools for an entire reactor core.

--Producing an equal amount of electricity without the Maple Island plant would cost an additional $160 million each year.

--This plan will minimize transportation of spent fuel.

--This plan will minimize disruption in the plant's structure and operation.

--No away-from-reactor storage is currently available.

--Neutron absorbers in the racks and pool water will prevent the creation of a reactor in the pools.

--Other energy sources (solar, geothermal, etc.) are not currently available to provide electricity equal to that generated by the Maple Island plant.

--Experts believe that nuclear power is an energy source that can be relied upon with reasonable safety.

--If the storage capacity is not expanded, the plant will have to be closed.

--"Zero risk" in any human endeavor can never be assured.

--The use of nuclear energy is one way for the United States to become more energy independent.

Reject the Proposed Expansion

--Packing spent fuel rods this closely has never been done before; no one is absolutely certain what will happen.

--The federal government is unlikely to have a permanent storage facility for nuclear waste for about 30 years.

--Nuclear power is subject to many accidents; a reactor accident could influence conditions in the spent-fuel pools. The greater the amount of spent fuel in the pools, the greater will be the effect of such an accident.

--Nuclear contamination could lead to severe health hazards, including increased incidence of cancer and potential genetic effects.

--Nuclear wastes pose a health hazard for an extremely long period of time, and they should be isolated as completely as possible.

--Spent-fuel pools were originally designed to hold spent fuel for only a few weeks or months, not for several years.

--Federal programs for disposal of nuclear waste have faced many serious problems in the past.

--Acme has not demonstrated effective planning and could have avoided the need for the proposed expansion.

--More-effective conservation programs could lead to decreased use of electricity; thus, the electricity generated by the Maple Island Plant would not be needed.

Allow a Compromise Expansion

--A careful, detailed study of the environmental impact of the proposed expansion should be done.

--A smaller increase in storage capacity should be granted to allow Acme enough time to construct a new pool.

--No one believes that the plant will actually be forced to close, so some expansion will be granted.

--Allowing expansion with a time limit will ensure that Acme will take appropriate action to make more careful plans for the storage of spent fuel.

--An absolute deadline on storage at nuclear power plants will put pressure on the federal government to speed up its nuclear waste disposal program.

Day 3-4: Research: Preparation for the Public Hearing

NOTE: A major component of this activity is to involve the students in research on the topic of nuclear reactors and spent fuel storage. Each group of students will be responsible for locating information from a variety of sources to support its position on the "Hot Rods" issue. Each group will collect at least one piece of information per person which they will use to support their arguments. They will share these materials with the rest of the class through a classroom resource center on Day 5.

Ideally, the teacher will be able to photocopy these materials for inclusion in the resource center. If this is not possible, students should check out materials for classroom use.

A list of suggested resources is provided in Handout 1h. Not all of these resources may be available to all schools and communities. Students should be encouraged to consult the local library as well as the school library, to contact local organizations, and to look for information on this topic relevant to their own state or region. Also, distribute to each group a copy of Handout 1j, "Maple Island Nuclear Reactor Data Packet," which contains a glossary, diagrams of the reactor, and other general information. Materials in this packet should supplement but not replace library research.

A. The Parkland Hearing Examiners Panel will use Part II of Handout 1g, "Hearing Examiners Panel Group Worksheet" as a guide to its library research. Members must identify important questions for each alternative course of action, locate through the library or other sources information related to these questions, and record the references on the worksheet. This process will help them prepare for the public hearing. To question each of the advocacy groups after their presentations at the meeting, the examiners must have a clear understanding of all the information collected through research. In addition, the hearing examiners should study Handout 1i, "How to Run a Public Hearing."

B. While the hearing examiners panel is conducting its research, the other three groups complete Handout 1f, "Hot Rods Group Worksheet" in preparation for the public hearing. This will require them to find information to support the reasons they outlined on Day 2 for their positions.

Teachers should remind students that the quality of each group's presentation, and ultimately its influence on the final decision, will depend on how rigorously group members conduct their research, how carefully they select relevant data, and how clearly they communicate this information during the public hearing.

Day 5: Research Sharing

A. To insure that all groups have equal access to information, Day 5 is designed as a resource sharing day. All materials compiled by all groups are to be made available in a classroom resource center. Tables at the back of the room or boxes with file folders can serve as the resource center. Each group should spend the first half of class looking at materials compiled by others. Instruct students to make notes of how these new materials might affect their own evidence, how to counter opposing or conflicting material with their own evidence, and so on. The hearing commissioners group AND THE TEACHER should be very careful to become familiar with all the evidence compiled.

B. During the last half of class, each of the three advocacy groups will go through its group worksheet and prepare arguments for the hearing to take place on Day 6. Each group will discuss how its presentation will be made. They will each pick a spokesperson and three witnesses to present at the hearing on Day 6. The spokesperson for each group will prepare to present the main arguments and supporting information, and each witness will be responsible for adding some new perspective and information. The witnesses should not merely repeat the same points made by the spokesperson. Remaining group members will act as prompters during the hearing and thus should be confident of all evidence and procedure.

C. The hearing examiners group will spend the last half of class studying Handout 1i; "How to Run a Public Hearing." This group should also review all evidence in the resource center in order to be able to respond to all groups during the hearing.

At the end of Day 5, each of the four groups should be fully prepared for the public hearing.

Day 6: Public Hearing

A. The hearing examiners conduct an open meeting according to the schedule which is outlined on Handout 1i, "How to Conduct a Public Hearing." The group advocating the proposed expansion should make its presentation first. The spokesperson should briefly present the major arguments; three witnesses will present additional points. They should all refer to specific references when supporting their arguments. Following each presentation, the examiners should take several minutes to question the group to clarify its position. The pattern should be repeated for the reject-the-proposed-expansion group and the allow-a-compromise-expansion group. During the meeting, the examiners use the questions they identified on their worksheet to guide discussion. They should also ask each group for information on the costs and benefits of their proposed course of action. Part III of the "Parkland Hearing Examiners Worksheet" will be useful for this purpose.

B. After all three presentations have been made, an open question/answer and discussion session should be held.

C. When the discussion is completed, allow each group 2 minutes to plan a 1-minute final statement. Each group spokesperson presents the final statement to the hearing in the same order as the original arguments.

D. The examiners panel holds a brief (5 minutes) private discussion in which they reach a decision on the issue. The examiners panel then announces the chosen course of action to the other groups.

Day 7: Final Discussion (Debriefing)

This phase is crucial in helping students recognize what steps they have followed in the risk-management/decision-making process.

A. Each group should spend 5-10 minutes discussing how the panel's decision will affect the group members and the community.

B. The teacher holds a brief class discussion to identify the various ways the decision will affect different individuals.

C. Next, the teacher should have the class turn its attention to some of the key issues in the case. The following questions can be used to help guide the discussion:

--How important is the question of nuclear waste disposal to the nuclear power industry? Why?

--How important is it to society in general? Why?

--What are the major benefits and disadvantages of a nuclear power plant for Riverton? For society in general?

--How did concerns about health hazards affect the decision in this case?

--How did concerns about reactor safety affect the decision in this case?

--What role did the federal government play in this case? What role did the state government play?

--What is your personal position on nuclear power? On the disposal of nuclear waste? Did this activity affect your position? If so, in what way?

--Which pieces of information in the data packet were most convincing? Least convincing? Why?

--Which spokespeople were most convincing? Did you accept the testimony of government officials, company spokespeople, scientists, and regular citizens equally? Explain.

D. Finally, the class should consider carefully the decision-making and risk-management process, using the following questions:

--Did all groups recognize the same risks? Why or why not?

--Were there any risks on which everyone agreed? What evidence was used to identify these risks?

--Which risks were seen as most serious? Why? Which were seen as least serious? Why?

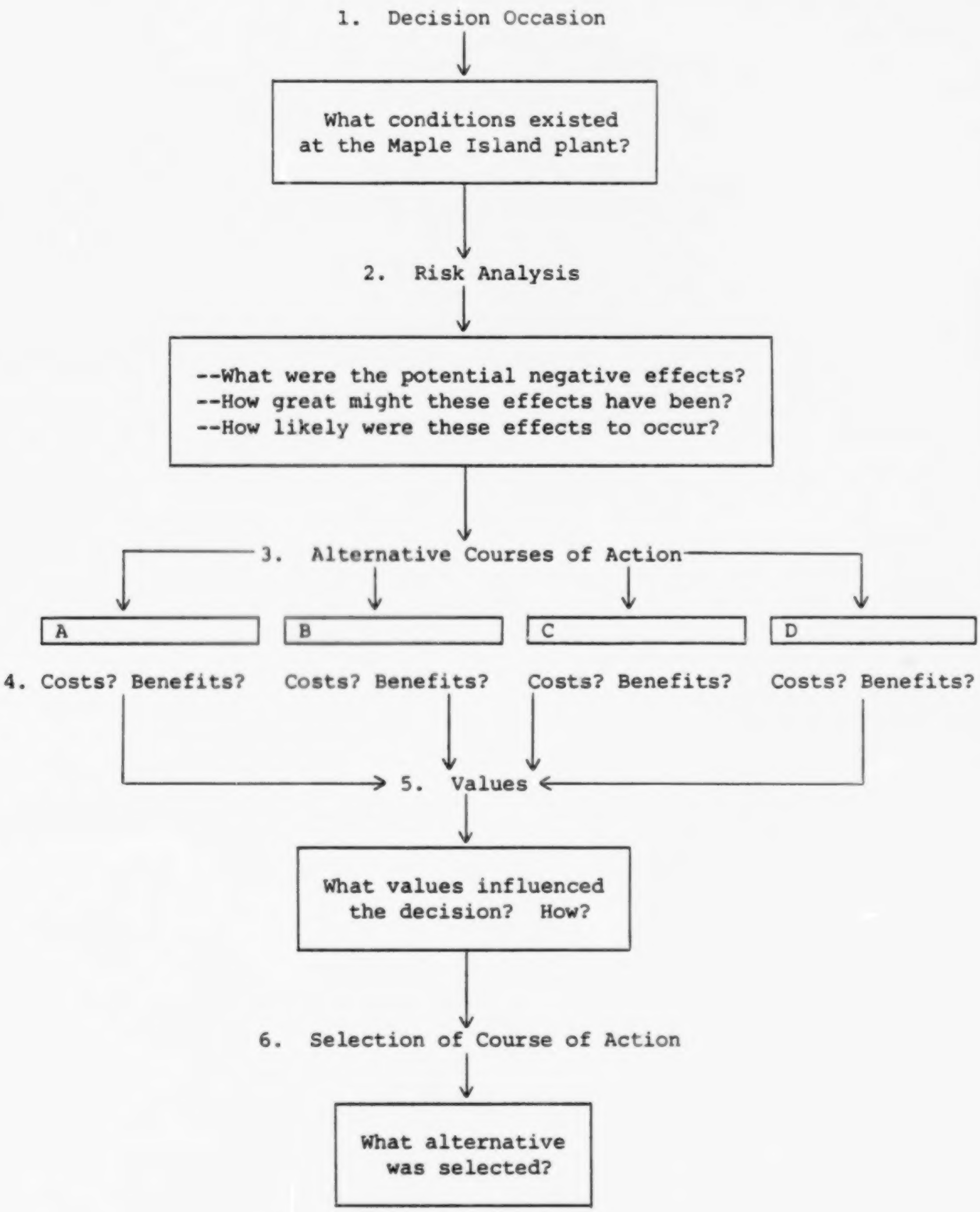
--Who (for example, residents, employees) faced the risks? Did they voluntarily face these risks?

--Do you think it is fair for businesses or government to create risks for people without their knowledge or approval? Why or why not?

--What values influenced the positions held by the different groups? How did these values affect the conflict over the proposed expansion of spent-fuel storage capacity?

--What role did technology play in this conflict? Did it help create the problem? Add to it? Help resolve it? Explain your answers.

E. Now turn the students' attention to the decision-making process. Have them review the six decision-making steps followed in this activity. Then use the framework below to review the process they followed in the case. As they answer the questions, you should fill in the framework on the chalkboard. This page may also be reproduced and assigned as homework at end of Day 6.


1. Decision Occasion
What conditions existed at the Maple Island plant?
2. Risk Analysis
--What were the potential negative effects?
--How great might these effects have been?
--How likely were these effects to occur?
3. Alternative Courses of Action
A
B
C
D
4. Costs? Benefits?
Costs? Benefits?
Costs? Benefits?
Costs? Benefits?
5. Values
What values influenced the decision? How?
6. Selection of Course of Action
What alternative was selected?

Ask the students to match the six decision-making steps with the six parts of the framework above. The following is a brief description of how they should match up:

Decision Making	Risk Management Framework
Defining the Issue	1. Decision Occasion 2. Risk Analysis
Recognizing Interests and Values	5. Values
Identifying Alternatives	3. Alternative Courses of Action
Locating and Using Information	All
Probable Consequences	4. Costs and Benefits
Selecting Course of Action	6. Selection of Course of Action

F. As a closure activity, go around room asking each student to share the most significant information they gained concerning nuclear waste or how they would now vote on a public referendum on this issue.

Handout 1a: BACKGROUND NOTES: NUCLEAR WASTE AND THE MAPLE ISLAND NUCLEAR GENERATING PLANT

This background guide for "Hot Rods" will help you understand the major issues related to nuclear waste storage and the specifics concerning an actual controversy, which is simulated in this role play in the fictionalized community of Riverton, Parkland.

Several important questions must be answered before the national controversy surrounding nuclear waste can be resolved. These questions focus primarily on the issues of reprocessing and the technology, environmental impact, and management of a permanent disposal program. The following information may help you understand some of the technical issues important in the nuclear waste controversy.*

Waste is the unusable material left at the end of an operation. Spent nuclear fuel and high-level radioactive waste cannot be diluted enough to be released to the air or water. They must be isolated from the human air supply, drinking water, and food chain for a suitable period of time--namely, until radioactive decay renders them harmless.

The fuel elements that are the source of high-level radioactivity in a nuclear power plant are not waste when they are removed from the reactor. For these elements, the end of the line need not be the generating station; it could be a chemical reprocessing plant in which unfissioned uranium fuel--the plutonium formed during reactor operation--and perhaps a few useful radioactive by-products are removed from the "spent" fuel elements. Only the residue from those processing steps is truly "waste." However, current U.S. government policy is to operate the nuclear power industry without reprocessing facilities.

Fuel elements that have spent several years producing energy in a power reactor are highly radioactive. This spent fuel can be moved from the generating plant to a disposal site without too much difficulty by using specially designed shipping casks. High-level radioactivity raises the temperature of surrounding material, so each thick-walled shipping container has its own built-in cooling system. The entire fuel element is encased in a cask that is built to survive a fire, collision in transit, or other severe accidents. But even if that safeguard should fail, the nature of the fuel form would tend to avoid any spread of radioactivity.

Why is it necessary to handle spent fuel so carefully and to take special precautions in storing or disposing of it?

---

* This information was drawn from: Durkerb, Joseph M., High Level Radioactive Waste: Safe Storage and Ultimate Disposal. U.S. Government Printing Office, 1975.

When an atomic nucleus fissions inside a reactor, it splits into smaller fragments. Each nucleus does not split in precisely the same way, so scores of quite different "fission products" may be formed inside a single fuel pellet. Some have very short radioactive "half-lives," and so they essentially vanish within minutes or hours or days. The unstable nuclei don't actually disappear completely; rather they are transformed by radioactive decay into different kinds of nuclei, which, in turn, may or may not be radioactive themselves. According to the rules of nature, all radioactive atoms eventually pass through different stages of decay until they reach one where they will no longer be subject to radioactive disintegration. Sometimes that takes a long, long time.

Consider strontium-90, for instance. This fairly common fission product's half-life is more than 28 years. Thus, a given amount of strontium-90 allowed to sit for that length of time (for example, dissolved in a tank of liquid or solidified inside a vault) will still be giving off half as much radioactivity and heat at the end of nearly three decades. In another 28 years it will have dropped one-quarter of its original level; 28 years after that it will be down to one-eighth; and so on. Clearly, over a century of storage won't solve everything if we start out with a substantial concentration of a fission product.

Another component of nuclear waste poses an even longer term problem. This is the heavier radioactive nuclides that are formed when the nucleus of an atom like uranium absorbes a neutron "bullet" instead of being split apart. Some of these big new nuclei decay very rapidly, like most fission products, but others have radioactive half-lives of thousands of years. The most important of these "heavy" radionuclides is plutonium.

For a nuclear reactor to operate, a certain amount of fissionable fuel material must be present in its core. Otherwise, an energy-releasing chain reaction simply could not take place. As a typical reactor functions, the amount of uranium in its core decreases steadily. Some of it changes into plutonium, but a greater percentage is split into fission products as the nuclear "binding energy" holding the uranium nucleus together is released. Plutonium is also fissionable, so a certain percentage of that newly-formed material joins in the chain reaction to extend the reactor's output.

Fission products act like a damper on the reaction, soaking up extra neutrons without releasing any appreciable amount of energy. As fission products build up, the reaction tends to bog down. Eventually, replacing spent fuel elements with fresh ones is more efficient and economical than leaving them in the reactor and trying to produce more fissions within the remaining fuel.

Many nuclear power reactors are designed so that a portion of the core is replaced annually. After the first few years a pattern develops in which each fuel element spends three or four years producing power before being removed. When removed, the fuel matrix still contains some of its original fissionable uranium, as well as fission products and a considerable amount of unfissioned plutonium potentially valuable as a fuel for other reactors, but highly radioactive.

Most fission products emit radiation that is quite penetrating. To block this radiation, relatively heavy shielding is required. Plutonium, on the other hand, generally decays by emitting "alpha particles." This type of radiation can be stopped by a comparatively simple shield--even a piece of paper. The alpha wastes produce very little heat.

The biological danger from plutonium develops only if it actually gets into the human system by being inhaled or absorbed by the body. Obviously there are many ways of preventing this, but it has always seemed advisable to take multiple precautions. If it should be ingested, some plutonium would tend to remain in the system rather than being eliminated by natural processes. Under those circumstances, its radiation could do severe damage.

Unfortunately, the half-life of plutonium-239 (the radioisotope that accounts for between 60 and 70 percent of all the plutonium in spent fuel) is about 25,000 years. That's why deep burial in dry salt formations has been under study since the early days of nuclear power. Geological evidence indicates that such burial could seal off the wastes until all potential danger from them had passed.

In addition to burial in salt formations, a wide range of other disposal techniques are currently under study. Until a permanent disposal program becomes operational, controversies such as that represented in the Maple Island hearings role play will continue to arise as utilities seek to expand their storage capacity for spent fuel.

The "Hot Rods" Role Play

The fictionalized Maple Island Nuclear Generating Plant in Riverton, Parkland, has two Westinghouse pressurized water reactors, each with a nominal electrical output of 530 MW(e). These base load units produced 7.735 billion kwh of electricity in 1978; this was nearly 30 percent of Acme Electric Power Company's electrical production. This contribution of the Maple Island plant has been made to Acme's system each year since both units became operational.

Each Maple Island unit has 121 fuel assemblies which make up the reactor core. These fuel assemblies, which are made up of enriched uranium fuel rods, measure roughly seven inches square by fourteen feet. On an approximately annual basis, each reactor is shut down for refueling; at this time about 40 fuel assemblies (one-third of the reactor core) are removed from the reactor and replaced with new fuel assemblies. The spent fuel assemblies are moved to the spent-fuel pools for storage.

"Spent fuel" consists of commercial reactor fuel assemblies which have been irradiated in the reactor core until they have been exhausted, or "spent," as a fuel source. When removed from the reactor, they generate enormous heat and contain highly radioactive fission product nuclides, uranium, actinides, and plutonium. The latter element is one of the most toxic known to man. Because it is lethal in miniscule amounts and because its predominant isotope Pu-239 has a half-life of 25,000 years, plutonium must be isolated from the biosphere for approximately 250,000 years.

The spent fuel assemblies are removed from the reactor because they are no longer able to efficiently sustain normal reactor operation. However, some fissionable materials capable of maintaining a nuclear reaction remain in the spent fuel. For this reason the nuclear industry originally planned to send spent fuel, following short-term storage, to nuclear fuel reprocessing facilities to extract the valuable energy resources remaining in the spent fuel.

When the Maple Island plant was constructed, Acme intended to ship the spent fuel to a commercial reprocessing facility. This plan influenced the fuel storage rack design. Two spent-fuel pools provided the capacity to store 210 fuel assemblies. The larger of the two pools was designed to store spent fuel, while the smaller pool was intended primarily to handle a spent-fuel shipping cask.

The spent fuel is stored in stainless steel racks which rest on the floor of the spent-fuel pool. Viewed from the top, spent-fuel storage racks resemble honeycombs. The racks are constructed so that fuel assemblies are stored vertically, each in its own cavity. The assemblies must be kept far enough apart to prevent the attainment of "criticality," which would result in a sustained nuclear reaction. All fuel-handling operations in the pool are performed under water. The water cools the hot spent fuel and acts as a shield from radiation. The water is kept deep enough in the pool that a 14-foot assembly can be suspended above the racks without breaking the surface.

The original pool storage capacity was based on the idea that the pool should hold the normal annual 40-assembly discharge from each reactor during its holding period (60-120 days) prior to shipment for reprocessing, plus one entire reactor core (121 assemblies) in the event there was scheduled or unanticipated removal of all the fuel from one unit for equipment inspection or modification.

In the mid-1970s, it became apparent that reprocessing facilities would not be fully operational in time to take spent fuel from the Maple Island plant, so a modification project was initiated in 1975 to increase the pool storage capacity. The goal of the mid-1970s project was to provide enough spent-fuel storage capacity to keep the Maple Island plant operational until reprocessing facilities became available.

The new pool layout, which used existing space more efficiently, called for 132 storage locations in Pool 1 for full core off-load capability and 555 storage locations in Pool 2 to accommodate normal annual refueling. By early 1977, the design was complete, materials had been received, fabrication was initiated, and the Nuclear Regulatory Commission (NRC) licensing review was nearly complete.

At that time, a shift in the federal government's policy caused a significant change in the uranium fuel cycle. On April 7, 1977, President Carter issued a statement outlining his policy on continued development of nuclear power in the United States. As a part of that policy, he declared, "We will defer the commercial reprocessing and recycling of plutonium produced in the U.S. nuclear power programs. From our own experience, we have concluded that a viable and economic nuclear power program can be sustained without such reprocessing and recycling."

The Carter Administration recognized the spent-fuel storage needs of operating nuclear plants in the absence of a commercial reprocessing program. The Energy Research and Development Administration (ERDA) was instructed to determine the spent-fuel storage needs of utilities in away-from-reactor (AFR) storage and develop plans to meet those needs by 1983. The Department of Energy (DOE), successor to ERDA, assumed these responsibilities and was working on a spent-fuel storage policy at the time of the hearings treated in this activity.

After the first modification of Maple Island's spent-fuel pool, spent-fuel assemblies continued to accumulate in the pool. At the time of these hearings, 320 assemblies were in the pool. Acme was again claiming that shutdown of Maple Island was inevitable, this time in 1985, unless the old stainless steel spent-fuel racks could be replaced with "absorber" racks having a greater capacity. "Absorber" racks consist of storage cavities whose walls have three layers--a layer of Boraflex sandwiched between two layers of stainless steel. Boraflex is a neutron-absorbing alloy which allows spent fuel assemblies to be placed closer together without reaching critical mass. Acme proposed to enlarge the capacity of the spent-fuel pool from its capacity of 687 to a total of 1582.

The proposed modification, based on state-of-the-art spent-fuel storage concepts, would increase the pool storage capacity to the maximum extent within the confines of the existing pool walls. The maximum expansion was proposed for several reasons:

1. It complied with DOE and Congressional assumptions that onsite storage would be expanded to the maximum.

2. The inservice date for an AFR facility was uncertain.

3. Completing the modification all at one time would be cost-effective.

4. Modifying the large pool with all the spent fuel in the small pool (the last date this was deemed to be possible was summer and fall 1981) has recognizable advantages.

The proposed sequence of installation of the new racks was to store all spent fuel currently in the pool in the west end of Pool 2. All existing racks would then be removed from Pool 1, and the new high-density absorber racks would then be installed. The stored spent fuel would thereafter be moved into the new racks in the smaller Pool 1 and a specially designed steel cover would be placed over that pool. The old racks in Pool 2 would then be replaced.

Acme requested approval to carry out its proposal from the Parkland Energy Agency (PEA) and from the NRC. A contested case hearing was ordered by the PEA director. Several interested citizens filed petitions to intervene and were granted party status by the hearing examiner panel.

The role profiles in this activity reflect the arguments that were made in the original hearings.

Handout 1b: HOT RODS ACTIVITY TIMELINE

	Day 1	Day 2	Day 3-4	Day 5	Day 6	Day 7
Parkland Hearing Examiners Panel	--Participate in introductory activities --Receive role assignments, form groups --Prepare for preliminary hearing	--Conduct preliminary hearing --Prepare and distribute press release --Receive handout 1g; begin research	--Conduct research in order to prepare questions on alternative courses of action --Prepare for running hearing	--Compare research findings in class --Finalize preparation for running a hearing	--Conduct public hearing --Listen to presentations of other groups --Question other groups on cost/benefits of alternative courses of action --Reach decision	--Discuss how Riverton will be affected by decision --Participate in class discussion and debrief
Allow Proposed Expansion Group Reject Further Expansion Group Allow Compromise Expansion	↓	--Participate in preliminary hearing --Identify reasons for group's course of action --Begin research	--Research --Identify supporting evidence	--Compare research findings in class --Select spokesperson and three witnesses --Prepare presentations for meeting	--Make group presentations --Answer questions from other groups --Listen to other groups' presentations --Ask questions of other groups	↓

Handout 1c: INSTRUCTIONS TO GROUP LEADERS

YOUR PRIMARY TASKS ARE TO ASSEMBLE YOUR GROUP AND GUIDE THE GROUP IN PREPARING A LOGICAL ARGUMENT FOR ITS POSITION. HELP THE GROUP SELECT A SPOKESPERSON AND UP TO THREE WITNESSES WHO WILL BE CALLED ON TO SPEAK AT THE HEARING. EACH GROUP MEMBER SHOULD PRESENT AND EXPLAIN AT LEAST ONE REASON FOR THE GROUP'S POSITION. YOUR GROUP SHOULD TRY TO PROVIDE AS MUCH STRONG EVIDENCE AS POSSIBLE TO SUPPORT ITS POSITION. BE SURE EVERYONE HAS LOOKED CAREFULLY AT THE AVAILABLE DATA. YOU SHOULD ALSO CONSIDER ALL THE CONSEQUENCES OF THE VARIOUS ALTERNATIVES BEING DISCUSSED.

Handout 1d: RISK ASSESSMENT

It is important to clearly understand the implications of the issue facing your group. One way of doing this is to assess the risks involved in increasing the capacity of the spent-fuel pools at the Maple Island Power Plant.

Use the following questions and information from your role cards to make this risk assessment.

1. What potential negative effects may result from increasing the capacity of the spent-fuel pools at the Maple Island Power Plant?
    a. Who will be likely to experience these effects?
    b. Where or how widely will these effects be experienced?
    c. How soon are these effects likely to be experienced?
    d. How easy will it be to reverse these effects? Why?

2. How great are these negative effects likely to be?
    a. How many people and what type are likely to be affected physically or psychologically?
    b. How great is the environmental damage likely to be?
    c. How costly are these effects likely to be?

3. What are the chances that these negative effects will actually occur?

Handout 1e: PRESS RELEASE

HEARING HELD TO CONSIDER RISKS OF EXPANDING CAPACITY FOR STORAGE OF SPENT FUEL AT MAPLE ISLAND

At a hearing yesterday the Parkland Hearing Examiners Panel discussed the potential hazards of proposed expansion of spent-fuel storage capacity at the Maple Island Nuclear Power Plant. Among the questions considered were:

- --What are the likely negative effects?
- --How great are these negative effects likely to be?
- --What are the chances that these negative effects will actually occur?

Potential negative effects identified by various spokespeople at the hearing included. . .

There were speculations on the extent of these effects. Some of those discussed were. . .

Much of the discussion focused on the likelihood that these various effects would occur. General feelings included. . .

Handout 1f: HOT RODS GROUP WORKSHEET

PART I: Participants

Name of Your Group's Spokesperson:

____

Other Group Members:

____

____

____

____

Name of Your Group's Witnesses:

____

____

____

PART II: A Recommended Course of Action

1. State clearly the course of action your group believes would be best to follow:

____

____

2. Based on the information presented in your role cards and in the "Background Notes", what are all the possible reasons for your position? For example, if your group advocates the proposed expansion, its reasons may include:

   --Parkland needs the energy from the Maple Island plant.

   --The new racks will ensure safe storage.

   --The federal government will provide away-from-reactor storage in a few years.

   --There is very little risk of an accident at the Maple Island plant.

   LIST YOUR GROUP'S REASONS IN THE SPACES ON THE LEFT-HAND SIDE OF THE CHART ON PAGE 2. EACH GROUP MEMBER SHOULD IDENTIFY AT LEAST ONE REASON.

PART III: Research

Through library research, find information to support each reason you listed for question 2. For example, look at the second reason above--"new racks will ensure safe storage." What evidence is available to support this reason? ENTER YOUR REFERENCE ON THE RIGHT-HAND SIDE OF THE CHART BELOW.

	Reasons	Supporting Information
A.	______________________ ______________________	______________________ ______________________
B.	______________________ ______________________	______________________ ______________________
C.	______________________ ______________________	______________________ ______________________
D.	______________________ ______________________	______________________ ______________________
E.	______________________ ______________________	______________________ ______________________
F.	______________________ ______________________	______________________ ______________________

PART IV: Costs and Benefits

1. Outline briefly the costs and benefits of taking the course of action recommended by your group. This information will help you clearly state arguments for your position during the public hearing. Cite references you have identified next to specific costs and benefits. An example is provided for you here.

Example: Reject the proposed expansion.

Costs	Benefits
--Loss of electricity produced by the Maple Island plant	--Smaller amount of spent fuel stored at Maple Island
--Potential loss of jobs	--Lessening of potential effects of an accident at the plant
--Possible loss of new businesses and industry in Riverton and throughout Parkland	--Less risk of health problems to the community
--Higher electricity rates for residents of Riverton and Parkland	

Your Group's Alternative Course of Action: ______________________________

____

____

Cost	Reference	Benefit	Reference

Use a separate sheet of paper if necessary.

Handout 1g: HEARING EXAMINERS PANEL GROUP WORKSHEET

Your group is charged with making a decision on the proposed expansion of spent-fuel storage at Maple Island. You must decide what is to be done on this issue. Of course, many questions must be raised and answered.

PART I: Alternative Courses of Action

As a group, you should clarify the possible courses of action which may be taken in this case. List these alternative courses of action below (remember, each alternative for regulation should consider WHAT, HOW, and WHO):

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

PART II: Questions for the Public Hearing

During the public hearing, you will want to ask questions of each group to help clarify their arguments. This will help you to make a good decision. Each role has several questions or concerns. These should be listed, along with other questions that come to mind, in the appropriate areas below. Some questions may be asked of more than one group. Finally, you will spend time researching answers to these questions and educating yourselves. You want to be knowledgeable decision makers. Place the references you find that you think help to answer the questions on the worksheet.

ALTERNATIVE 1: ______________________________

____

	Question	Reference
A.		
B.		
C.		
D.		

ALTERNATIVE 2: ______________________________

____

	Question	Reference
A.		
B.		

C.

D.

ALTERNATIVE 3:

	Question	Reference
A.		
B.		
C.		
D.		

PART III: Costs and Benefits

For each alternative presented during the meeting, outline the costs and benefits of taking that course of action. COMPLETE THIS SECTION DURING THE PUBLIC HEARING. A partial example for one alternative course of action is provided for you. Be sure to add costs and benefits as they are mentioned by the groups and to ask for clarification where necessary. This will help you make your final decision.

Example: Reject the proposed expansion.

Costs	Benefits
--Loss of electricity produced by the Maple Island plant	--Smaller amount of spent fuel stored at Maple Island
--Potential loss of jobs	--Lessening of potential effects of an accident at the plant
--Possible loss of new businesses and industry in Riverton and throughout Parkland	--Less risk of health problems to the community
--Higher electricity rates for residents of Riverton and Parkland	

Group 1, Proposed Course of Action: ______________________________

____

____

____

Cost	Reference	Benefit	Reference

Group 2, Proposed Course of Action: ______________________________

____

____

____

Cost	Reference	Benefit	Reference

Group 3, Proposed Course of Action: ______________________________

____

____

Cost	Reference	Benefit	Reference

Handout 1h: SUGGESTED RESOURCES ON NUCLEAR ENERGY

Listed below are some journal articles, library resources, and contact organizations to get you started on compiling information for the upcoming examiners hearing. Note: Some of your best information will come from recent newspaper and magazine articles, so be sure to check the Reader's Guide to Periodical Literature, Magazine Index, and any newspaper indexes available in your school or local library.

GENERAL LIBRARY RESOURCES

Annual Editions: Environment 84/85. Guilford, CT: Dushkin Publishing Group, 1984.

Collins, Carol, ed. Nuclear Energy. Editorials on File. New York, NY: Facts on File, Inc., 1985. A compilation of editorials debate the pros and cons of nuclear energy and related issues.

Energy. Boca Raton, FL: Social Issues Resources Series, Inc. (SIRS), 1985. A loose-leaf "vertical file" containing hundreds of newspaper and magazine article reprints.

Facts on File. New York, NY: Facts on File, Inc., 1985. A weekly digest and index of news, compiled from major national and international newspapers.

Ferrara, Grace. Atomic Energy and the Safety Controversy. New York, NY: Facts on File, Inc., 1985.

Hedley, Dan. World Energy. The Facts and the Future. New York, NY: Facts on File, Inc., 1985.

Taking Sides: Clashing Views on Controversial Environmental Issues. Guilford, CT: Dushkin Publishing Group, 1984.

JOURNAL ARTICLES

Abrams, Nancy, and Joel Primack. "Helping the Public Decide: The Case of Radioactive Waste Management." Environment 22(April 1980): 14-20.

LaPorte, Todd. "Managing Nuclear Waste." Society 18(July-August 1981): 57-65.

Nash, Thomas. "Nuclear Fuels." Geotimes 28(February 1983):28-29.

Perrow, Charles. "Normal Accident at Three Mile Island." Society 18(July-August 1981):17-26.

JOURNALS

Energy Digest

Environment

National Geographic

Science Digest

CONTACT ORGANIZATIONS

Energy Resource and Development Administration. Washington, DC 20545.

League of Women Voters. 1730 M St., N.W., Washington, DC 20036. (A Nuclear Power Primer: Issues for Citizens)

Nuclear Information and Resource Service. 1346 Connecticut Avenue, N.W., Washington, DC 20036.

Worldwatch Institute. 1776 Mass. Ave., N.W., Washington, DC 20036. (Nuclear Power: The Market Test).

Handout li: HOW TO RUN A PUBLIC HEARING

1. Announce the purpose of the meeting at the beginning.

2. Strictly enforce time limits on each group.

3. In order to maintain control:

   --Have all comments addressed to you.

   --Call on people who raise their hands.

   --As much as possible, give each group equal time.

   --Stress the need for participants to refer to specific sources of information when presenting arguments.

   --Question group members, but don't squabble with them.

   --Have all presenters initially state their names, places of residence, if possible, and professions.

4. Your agenda should be:

   a. Allow-proposed-expansion group

      (1) Group leader

      (2) Maximum of three additional witnesses

      (3) Questions to that group from the hearing examiners

   b. Reject-the-proposed-expansion group (same as above).

   c. Compromise-expansion group (same as above).

   d. General discussion and questions from the hearing examiners.

   e. Concluding remarks (1 minute) from each group.

   f. Hearing examiners confer, then announce decision.

   g. Discussion of reasons for chosen course of action.

Handout 1j: MAPLE ISLAND NUCLEAR REACTOR DATA PACKET

This packet contains documents to help you prepare for the upcoming Parkland hearing. The documents are: I, A Glossary of Nuclear Energy Terms; II, Spent Fuel: General Information; III, Maple Island Spent Fuel Storage Plan; IV, Maple Island Fuel Handling System; V, Pressurized Water Reactor System in the Maple Island Plant; and VI, Spent Fuel Storage Rack: General Information.

Use the information in this packet to supplement your library research.

I. A Glossary of Nuclear Energy Terms

Absorber - Any material that absorbs or decreases the degree of radiation. Neutron absorbers, such as boron and cadmium, are used in fuel assemblies and in some storage racks for spent fuel. Boric acid may be added as an absorber in water used in spent-fuel storage pools. Concrete and steel absorb gamma rays and neutrons in reactor shields.

Atom - The smallest particle of an element. There are about 6 sextillion (6,000,000,000,000,000,000,000) atoms in an ordinary drop of water. Each atom contains a dense inner core (nucleus) and a much less dense outer area made up of electrons.

Chain Reaction - A reaction that continues to repeat itself. In a nuclear reactor a neutron (a piece of an atom's nucleus) strikes a nucleus, splitting that nucleus and releasing more neutrons, which in turn strike other nuclei. This chain reaction releases heat and produces energy.

Cladding - An outer shell surrounding nuclear fuel elements. It helps to prevent the release of radioactive material into the reactor coolant. Aluminum, stainless steel, and cadmium are common cladding materials.

Coolant - A substance circulated through a nuclear reactor or a spent-fuel pool to remove or transfer heat. Water is one of the most common coolants.

Core - The central part of a nuclear reactor containing the fuel assemblies.

Criticality - The state of a nuclear reactor when a chain reaction is taking place.

Curie - The basic unit of measure of the rate at which material gives off radiation. One curie is equal to the amount of radiation given off by one gram of radium in one second.

Disposal - To dispose of something means to get rid of it. Since storing nuclear waste does not get rid of it, storage should be clearly distinguished from disposal. Disposal of nuclear waste means isolating it from the human air supply, drinking water, and food chain until radioactive decay makes that waste harmless. For some radioactive materials this may require thousands of years.

Enriched Uranium - There are different kinds (isotopes) of uranium. Most natural uranium has only about 1 percent of the kind that is fissionable (will maintain a nuclear chain reaction). To make nuclear fuel the uranium is changed to contain about 3 percent of the kind that is fissionable. This change is called enrichment.

Fission - Splitting the nucleus of a uranium atom. This splitting (fission) releases a great deal of energy (heat). The heat is used to create steam to turn a turbine, which powers a generator that produces electricity.

Fuel Assembly - A group of fuel rods bundled together, usually in a rectangular shape.

Fuel Element - A rod, tube, or plate made up of small pellets of enriched uranium.

Fuel Reprocessing - Much material in spent fuel is still fissionable. To recover this unused fissionable material the spent fuel can be reprocessed. The material remaining is truly nuclear waste.

Genetic Effects of Radiation - Exposure to radiation can lead to physical changes in individuals. If these changes are transferred from parents to their offspring, they are genetic effects.

Half-Life - The radioactivity of any material decreases by one half in a certain number of years. It takes the same number of years for one half of the remaining radioactivity to disappear, and so on. The longer a material's half-life, the longer it will take to lose all of its radioactivity or to reach "safe" levels of radioactivity.

Isotope - One form of an element. The isotopes of any element differ slightly in weight.

Nuclear Reactor - A device for splitting atoms in a chain reaction at a controlled rate. The necessary part is a core of material which is fissionable.

Plutonium - An element that is created by the fission of uranium. One kind of plutonium is fissionable and is used in the manufacture of nuclear weapons.

Pressurized Water Reactor - The nuclear reaction heats water that is kept under very high pressure to keep it from boiling. This hot water then is pumped through pipes in a steam generator. The hot pipes turn water in the generator into steam. This steam turns a turbine which powers a large electric generator.

Radiation Units - Three units are used to measure the effects of radiation. The roentgen measures the effects of x-rays and gamma rays in the air. The rad is a measure of the amount of radiation absorbed by material. And the rem (which stands for radiation equivalent man) is a measure of the biological effects of radiation. For most practical purposes, these units can be used interchangerably--1 roentgen = 1 rad = 1 rem. One millirem equals 1/1000 of a rem. Radiation comes from both natural (for example, the sun) and human-made (nuclear power plants) sources. It is estimated that on the average each person in the United States is exposed to about 100 millirems of natural radiation each year. Currently, the federal government has set a standard of 170 millirems per person per year as the highest permissable dose from human sources of radiation.

Radiation - Energy traveling in the form of waves or particles. Some typical examples are microwaves, radio waves, radar, x-rays, and sunlight.

Radioactive Contamination - The presence of unwanted radioactive matter in any place where it may harm persons or make products or equipment unsafe for use.

Spent Fuel - Nuclear reactor fuel that has been used and cannot effectively sustain a chain reaction. Normally from one-third to one-fourth of a nuclear reactor's fuel is replaced each year.

Storage - This is temporary isolation of spent fuel in deep water-filled pools until a safe disposal technique is developed or until the fuel is reprocessed.

Storage Racks - The spent fuel assemblies are placed in racks in the storage pools. The racks resemble egg cartons and separate the fuel assemblies from one another. Some racks are constructed with material that absorbs radiation; this decreases the risk of a chain reaction starting in the storage pool.

Threshold Dose - The lowest dose of radiation that will produce a particular biological effect--for example, a case of cancer in a susceptible person. Although the threshold dose idea is simple, the question of whether or not a threshold dose actually exists is very controversial! The effects of low levels of radiation on humans are not precisely known. Information comes from high doses and high dose rates and animal experiments. Scientists disagree about how to use this information for predictions about low doses and low dose rates. Are several low doses absorbed at different times as dangerous as a single equivalent large dose? No, if the body's natural mechanisms can repair some damage between times. Yes, if the damage is irreversible so that only the total amount of radiation accumulated matters.

United States Nuclear Regulatory Commission (NRC) - The agency of the federal government responsible for licensing and regulating nuclear power plants. It also develops and enforces health and safety standards for nuclear plants.

Uranium - A natural element which is the basic raw material of nuclear energy. Enriched uranium is used as fuel for nuclear power plants.

II. Spent Fuel: General Information

The fuel in a nuclear reactor is in the form of uranium dioxide pellets stacked inside 12-foot-long tubes. These tubes are assembled into bundles. As the uranium atoms split in two, energy is released. This energy is used to produce heat which--through a technical process--produces steam. The steam, which does not come in contact with radioactive materials, causes a turbine to spin and produce electricity.

A bundle of fuel rods lasts about three years. Usually, once a year, the reactor is shut down and about one-third of the fuel bundles are removed and replaced with new fuel.

The spent fuel still produces heat and is radioactive, requiring continuous cooling and radiation shielding. This is done by handling and storing the fuel 40-50 feet under water. The fuel must be stored for at least 60-120 days before it can be shipped. The level of radioactivity decreases rapidly with time. The rate of production of heat also decreases with time. After one year, the heat produced by one bundle is equal to that produced by about twenty-seven 100-watt electric light bulbs.

III. Maple Island Spent Fuel Storage Plan

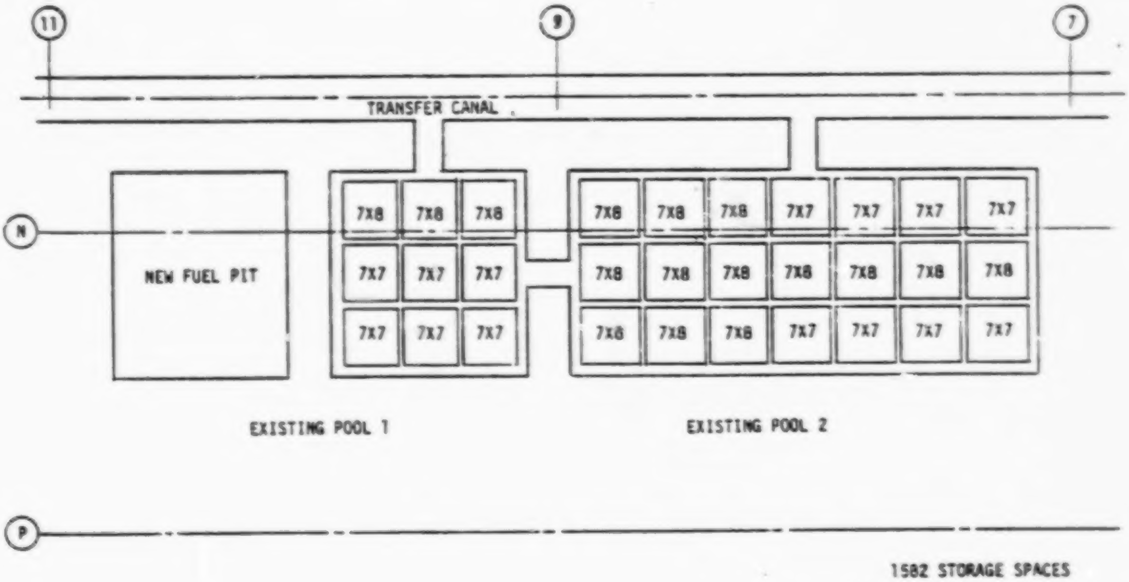
General Description

The Maple Island Spent Fuel Storage Facility consists of two storage pools. The first is a small fuel storage pool (pool 1) used for fuel storage and for loading of fuel into the shipping cask. The other pool (pool 2) is a larger pool used only for fuel storage. The arrangement of these two pools is shown in Figure 1.

In order to use a spent-fuel shipping cask in pool 1, it will be necessary to remove the four spent-fuel racks located in the southeast corner of that pool. Therefore, only the five remaining racks in pool 1 can be used for normal fuel storage. This results in the availability of 266 normal storage spaces in pool 1. The racks in the southeast corner of pool 1 can be used for a full-core discharge, since it is not necessary to use a shipping cask during a full-core discharge.

The spent-fuel pool structure and supports have been analyzed and found to be acceptable for the additional load imposed by the increased fuel storage capacity.

Two sizes of spent-fuel racks will be used: a 7 x 7 space rack and a 7 x 8 space rack. Installation of the new racks will expand the storage capacity of the pools to 1582 spaces.


11
9
7
TRANSFER CANAL
N
NEW FUEL PIT
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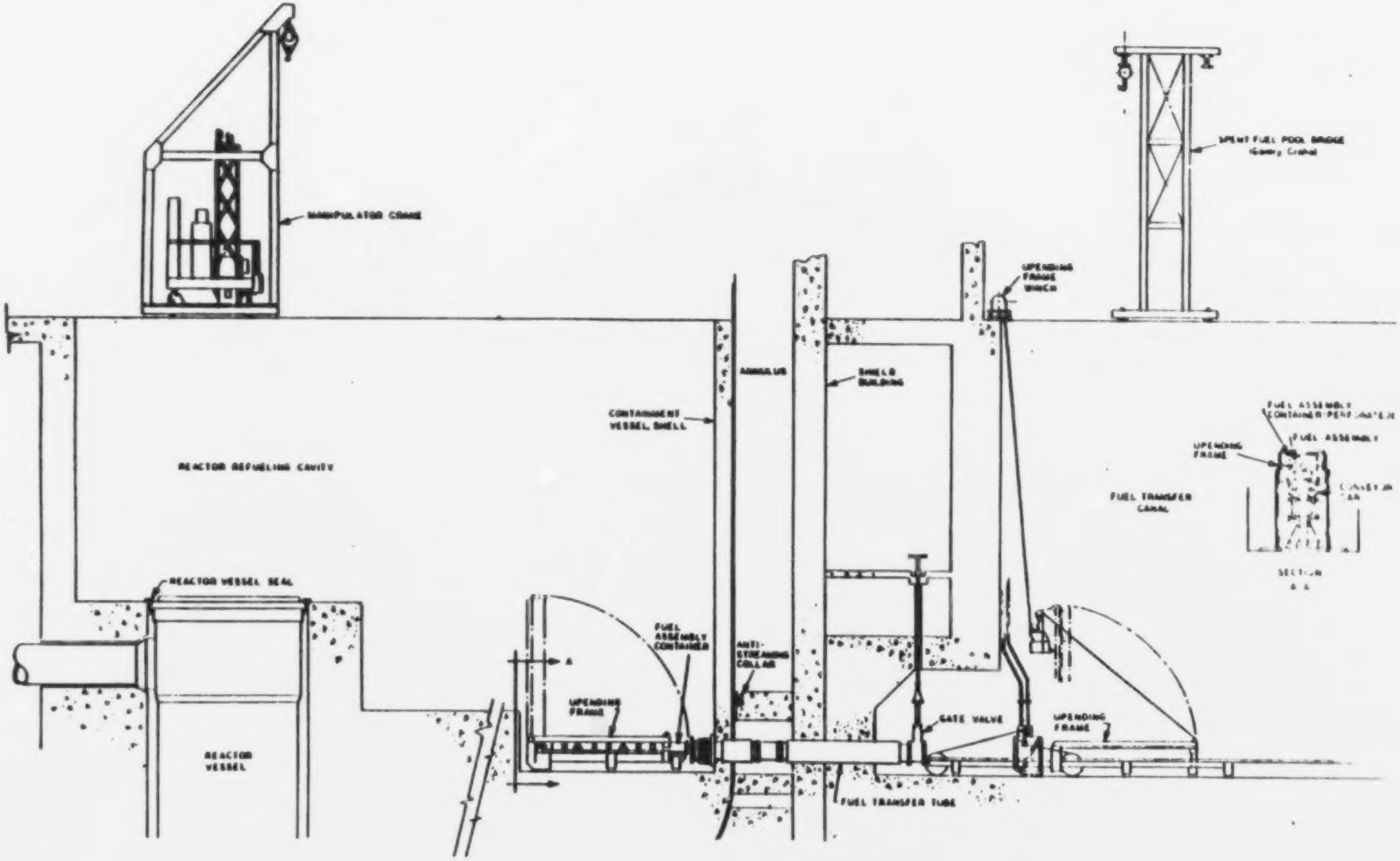
7X7
EXISTING POOL 1
EXISTING POOL 2
P
1582 STORAGE SPACES

HIGH DENSITY ABSORBER FUEL RACKS IN EXISTING POOLS

IV. Maple Island Fuel Handling System


MANIPULATOR CRANE
SPENT FUEL POOL BRIDGE (Gantry Crane)
UPENDING FRAME WINCH
ANNULUS
SHIELD BUILDING
CONTAINMENT VESSEL SHELL
REACTOR REFUELING CAVITY
FUEL ASSEMBLY CONTAINER (PERFORATED)
FUEL ASSEMBLY
UPENDING FRAME
CONVEYOR CAR
FUEL TRANSFER CANAL
SECTION A-A
REACTOR VESSEL SEAL
FUEL ASSEMBLY CONTAINER
ANTI-STREAMING COLLAR
A
UPENDING FRAME
GATE VALVE
UPENDING FRAME
REACTOR VESSEL
FUEL TRANSFER TUBE

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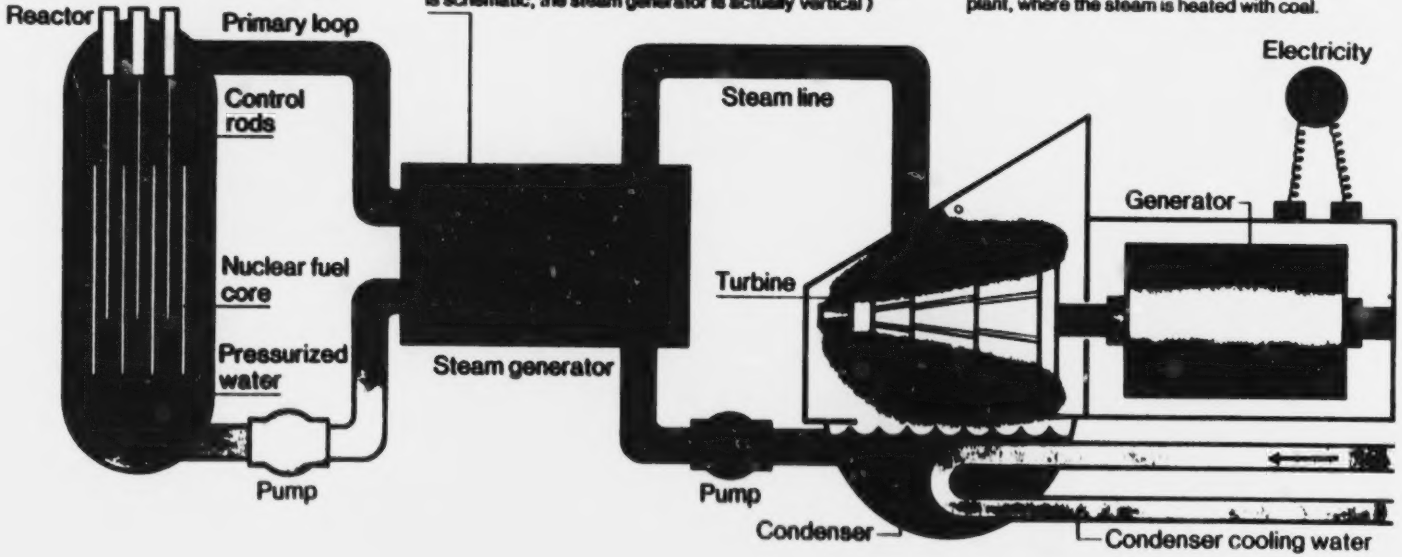
Pressurized water reactor system

Step 1.
Nuclear reactor heats water to about 550 degrees; the water doesn't boil because it is kept under pressure.

Step 2.
The hot water travels through a maze of more than 3,000 small pipes in a steam generator. Water flowing around the outside of these pipes is heated and turns into steam. (This is schematic; the steam generator is actually vertical.)

Step 3.
Steam then turns turbine, which in turn spins magnet in generator to produce electricity. This step is essentially the same in a coal-fired plant, where the steam is heated with coal.


Reactor
Primary loop
Control rods
Nuclear fuel core
Pressurized water
Pump
Steam generator
Steam line
Electricity
Generator
Turbine
Pump
Condenser
Condenser cooling water

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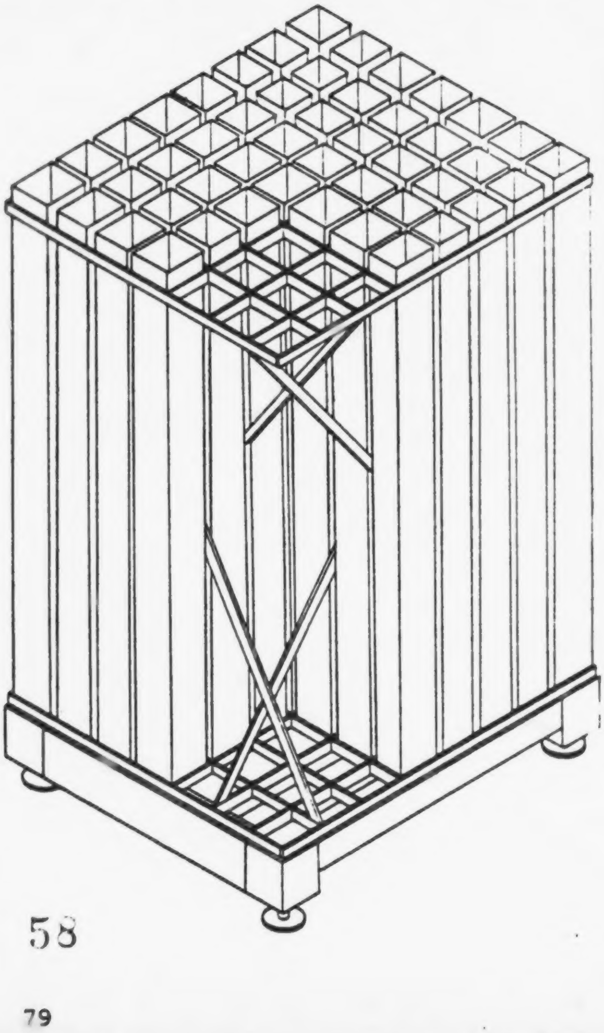
VI. Spent Fuel Storage Rack: General Information

The rack base is composed of heavy box beams connected at the four corners to box section legs with adjustable feet. These adjustable feet will provide adjustment during installation to ensure that the storage tubes are vertical. The box beams of the base are elevated above the pool floor to allow a flow of cooling water below the rack and up into the storage tubes.

The inner tube is of adequate length to extend from below the bottom of the fuel assembly to above the top of a stored fuel assembly. Two support bars are welded into the bottom of this inner tube, and the stored fuel rests on these support bars.

The layer of neutron absorber is located on the four outer surfaces of each inner tube. The neutron absorber is in the form of solid sheets of material provided by Carter Industrial Services Company. This type of material has been previously licensed by the NRC for use in spent-fuel racks. The material is composed of a silicon polymer base material with sufficient boron in the form of boron carbide to result in an area density of 0.04 grams/square centimeter of boron-10. The neutron absorber extends the full length of the active fuel.

The outer skin is a thin sheet of stainless steel which covers the neutron absorber and holds the absorber in place. This outer skin will completely enclose the neutron absorber.



P. E. HUBER

As a member of the Parkland Hearing Examiner's Office, you are responsible for hearing all the testimony related to the proposed expansion of spent-fuel storage at Maple Island. You must listen carefully to all evidence presented and make a careful, objective decision.

A major interest of yours is ensuring continued electrical service to the people of Parkland. State law prohibits any course of action which will lessen the safety, adequacy reliability, and efficiency of Parkland's energy supply.

Here are several questions you want to discuss:

--What is the forecast demand for electricity in the future? How accurate is this forecast?

--How can conservation programs affect the demand for electricity now and in the future?

--Are there alternative sources of electricity available? Can they be operational within three or four years?

--Is nuclear energy the most efficient and least expensive way of producing the needed electricity?

--How soon might the federal government provide an away-from-reactor (AFR) storage facility?

You believe that a permit to expand the storage of spent fuel at Maple Island should be granted only if the electricity from that plant is truly needed by the people of Parkland.

C.J. EMORY

You are one of the members of a panel of hearing examiners who will decide whether Acme Electric Power Company should be allowed to expand its spent-fuel storage at the Maple Island plant. Listening carefully to all testimony presented and examining all the evidence are two of your major responsibilities. After the public meeting, you and the other hearing examiners will reach a decision on Acme's proposal.

Before granting permission for the proposed expansion, you want to be certain that Acme has selected the most appropriate course of action. Marlene Sigal believes that Acme should have considered several alternative courses of action, and you agree with her. Among the questions you want discussed are:

--What reasonable alternative courses of action were considered by Acme? Why were the other options rejected?

--What evidence did Acme use to make its decision?

--Is the Maple Island plant the best means of providing energy for the people of Parkland?

--Is the cost of the proposed expansion more reasonable than that of other courses of action?

--Does this course of action lead to the most reliable electrical service for the people of Parkland?

Only after you have received answers to these and other questions will you be ready to make a decision on Acme's proposal.

Role Card HR-3

J. D. KELM

Since you joined the Parkland Hearing Examiner's Office 15 years ago, you have heard a large number of cases related to environmental concerns. You believe these cases are among the most important considered by the examiners. Since this case will affect so many people, you believe it is very important to remain impartial and objective in making your decision.

You think a good deal of attention should be paid to the potential environmental impacts of expanding storage of spent fuel at Maple Island. Here are some questions you want to discuss:

--How will the expansion affect the natural environment of the area around the Maple Island plant? In what way will the environment be affected?

--Will the proposed expansion protect the environment in any way? If so, how?

--How wide an area might be affected by the proposed expansion?

--How many people could be affected?

--Is there any way to ensure that the environment is not harmed as a result of the proposed expansion? If so, how?

--How easy would it be to reverse any negative environmental effects?

As you listen to each group make its presentation, you will want them to support their arguments related to environmental impact with as much hard information as possible. You will reach your decision on the basis of this information and information you gather yourself.

BRIAN LASKO

You take your responsibilities as a hearing examiner very seriously. Whenever you are to hear a case such as the proposed expansion of spent-fuel storage at Maple Island, you spend a great deal of time carefully studying all the available information and evidence. You consider yourself to be a very good listener and questioner. After hearing testimony, you almost always have a list of important questions to ask witnesses.

In this case your major concern is public health. You want to know:

--How might the health of people near the Maple Island plant be affected by the proposed expansion of spent-fuel storage?

--How easy to treat are the potential health impacts?

--Will the health impacts have future effects? If so, what kinds?

--What precautions are being taken to avoid any possible negative health impacts?

--What kinds of people will be most affected by health impacts?

You believe that the state has a responsibility to help people maintain a high quality of life. They should have a secure economic and social future, and they should be free of unnecessary health hazards. Only after your questions have been answered will you be able to make a decision on Acme's proposal.

MARLENE SIGAL

After completing law school more than ten years ago, you joined the staff of the Parkland Hearing Examiner's Office.

Since so many people are interested in the plan to expand Acme Electric Power Company's storage of spent fuel, you believe that the panel of examiners should be very careful in reaching a decision. In particular, you believe that all possible courses of action should be carefully explored. The "theoretical possibilities" for a nuclear plant to store additional spent fuel are:

--Store the spent rods closer together in the existing pools.

--Enlarge the existing pools.

--Construct a new pool or pools.

--Ship the spent fuel to the pool of another nuclear power plant.

--Ship the spent fuel to an away-from-reactor (AFR) storage facility designed to store spent fuel temporarily.

--Store aged spent fuel in underground, dry storage.

--Ship the spent fuel to a reprocessing center.

--Store the spent fuel in an "ultimate repository" of some kind.

The advantages and disadvantages of each of these options should be carefully considered. If none of these are suitable, the only alternative will be to close down the Maple Island plant.

MARK POVLOCK

As a member of the Parkland Hearing Examiner's Office, you are responsible for making a decision which will affect the lives of all residents of the state. Because the question of nuclear power is so emotional, you want to be sure to recognize the difference between arguments based on facts and those based on opinions as you listen to the arguments of various groups. You are also concerned about how much importance should be given to each factor. For example, should health be a more important consideration than economics? You want to discuss the importance of each of the following factors with the other hearing examiners: health (short-term and long-term), economic growth, economic costs, continued energy supply, impact on the environment, and social and psychological impact.

In addition, you think careful consideration should be given to the impact of not granting Acme permission to expand its storage of spent fuel. You want these questions discussed:

--How much energy can be saved through conservation programs?

--Without the Maple Island plant, what things will the people of Riverton have to give up?

--If the Maple Island plant closes, what alternative energy sources can be used to provide electricity for Parkland?

--How soon will these alternative energy sources become available?

--How much will energy from these alternative sources cost?

With the answers to these questions and others you will be better prepared to make a decision on the proposed expansion of spent-fuel storage at Maple Island.

TRACY ONO

The hearing on Acme's proposal to expand its spent-fuel storage capacity at Maple Island is one of the most complex you have conducted in all your years with the Parkland Hearing Examiner's Office. You are well aware that your decision must be based on all the available information as well as the arguments presented by the various groups. Your decision must be objective, and you must be able to defend it with supporting evidence.

You believe special attention should be paid to the proposal's economic impact. Among the questions you want discussed are:

--How dependent on Maple Island are the businesses of Parkland?

--If Maple Island is forced to close, how will Parkland businesses be affected?

--Will the expansion of spent-fuel storage make attracting new businesses to the Riverton area difficult?

--How much will expanding the spent-fuel storage at Maple Island cost? How much would other options cost?

--If a serious accident occurred at Maple Island, how many people, businesses, etc. would be affected? What would be the dollar value of damage?

--How much would cleaning up after a major accident at Maple Island cost?

The answers to these and other questions will help you to work with the other hearing examiners to reach a decision.

MARIE O'SHAUGHNESSY

You are the assistant manager of the Power Supply Planning Department at Acme Electric Power Company. After receiving bachelor's and master's degrees in electrical engineering, you went to work for Acme 12 years ago. The company has been good to you, and you believe it is providing the people of Parkland with excellent service.

In your position you supervise studies to determine the needs for future electricity production. In addition to providing power throughout Parkland, Acme is also a member of the Central States Power Pool, an organization of the major power companies operating in Parkland and seven nearby states. This pool ensures reliable electric service by sharing facilities and maintaining a generation reserve which can be used during emergencies. You believe that Acme needs the Maple Island plant to keep pace with the demand for electricity from its customers and the power pool.

The population and economy of Riverton and the rest of Parkland are growing. This growth must be matched by increased electric power for businesses, farms, and homes. The people of Parkland want this electricity. The Maple Island plant currently generates about 30 percent of Acme's electric energy, and the possible shutdown of the plant is of great concern to you. Without Maple Island the company's generating capacity would barely equal the peak demand for electricity. Acme would thus be left without reserve generating capacity and would not be prepared for generating losses caused by problems at other plants. Furthermore, its commitments to the Central States Power Pool could not be met.

Time and money are also important factors. The storage racks must be replaced within the next three years. If they are not, there will not be enough storage space in the pools for an entire reactor core. Such storage space would be needed if it became necessary to make repairs on the reactor.

If the Maple Island plant were forced to close, the company would have to spend an additional $160 million dollars each year to produce an equal amount of electricity. This expense would result primarily from increased use of coal (three million tons annually) and oil (forty million gallons annually).

It is clear to you that the Parkland Department of Energy should grant Acme the certificate of need to expand its storage capacity for spent fuel at Maple Island. This action will ensure reliable electrical service in the future.

TOM NAJARIAN

You are a nuclear physicist employed by the Los Alamos Scientific Laboratory (LASL), which is owned by the U.S. Department of Energy and operated by the University of California. The LASL engages in research in a number of areas, including nuclear and other forms of energy. Your work at the lab has included study of reactor design and safety.

The Parkland Department of Energy has hired you as a consultant on the issue of expanding capacity of the spent-fuel storage pools at Acme's Maple Island plant.

These are most important considerations in selecting the best method of storing spent fuel:

--Handling and transportation should be minimized.

--Sufficient cooling capacity must be present.

--Disruption in the plant's structure and operation should be minimized.

--Creation of a reactor in a storage facility must be avoided.

--Additional storage capacity must be available for use when the current storage is exhausted.

--The necessary technology must be available and must be economically feasible.

--Any hazards associated with the storage and handling of spent fuel must be minimized.

The plan proposed by Acme is the most desirable.

Enlarging the existing pool would take too much time because of design, construction, and permit requirements. Because of the physical layout of the Maple Island plant, new construction would interfere with its operation.

Building a new pool would also create time (4-6 years) delays for design, construction, and getting permits. Furthermore, spent fuel would have to be transported to the new pool, thus creating additional risks.

Storing the fuel at another nuclear plant's pool would require more handling and shipping of spent fuel. In addition, other utilities are faced with similar spent-fuel storage problems, so they are not likely to accept spent fuel from the Maple Island plant.

In short, Acme should be allowed to expand its storage in the existing pools at Maple Island. The advantages of Acme's plan are:

--It will minimize transportation of spent fuel.

--It will not create much disturbance at the plant.

--It includes two safety measures to guard against the creation of a critical system (reactor) in the storage pool: (1) a neutron absorber in the storage racks and (2) a neutron absorber (boric acid) in the pool water.

DONNA WILLIAMS

For the past 16 years you have been employed by Acme Electric Power Company (AEPC). During that time you have had assignments in Technical Services, Commercial Research, and Energy Services and Conservation. Your present position as general manager of Energy Management calls for you to supervise the development of energy conservation and efficiency programs.

Many people who oppose the use of nuclear power claim that effective conservation programs could eliminate the need for electricity generated by nuclear plants. They also believe that the use of alternate energy sources--solar, hydro, geothermal, and so on--should be expanded and nuclear sources phased. You think these people are not very well-informed.

AEPC has developed and put into effect a number of conservation programs over the past five years. From a technical standpoint, it would be possible to conserve 30-40 percent of our present use of electrical energy. Of course, this will never happen. Economic, social, political, legal, and other factors influence conservation programs and their effectiveness. The conservation programs that AEPC now has in operation have reduced the future forecasted needs for electricity. The impact of conservation is, however, primarily on future needs, not on current capacity, and Maple Island now provides about 30 percent of AEPC's customer's electricity needs. Those people depend on that electricity.

Furthermore, alternate energy sources, such as solar and geothermal, are not ready to take over in producing that 30 percent. Sure, the technology is developing fast, but it just hasn't reached the same stage of development as nuclear power. It will be many years before these sources will be as dependable as the Maple Island plant, and even then they may not be able to produce as much electricity as nuclear power does.

It is clear, then, that conservation and the use of alternate energy sources can help reduce future needs for electricity from nuclear plants, but for now such programs are not slowing down the demand for electricity enough to affect the need for power from Maple Island. Since both the company and its customers benefit from the low fuel costs of the nuclear plants, AEPC should be allowed to increase the amount of spent fuel it may store in the existing spent-fuel pools.

EDWARD QUINN

You are the editor of the Riverton Times, the local newspaper. In the past you led the fight against a coal-fired power plant built by Acme. Over the years you have come to know the management at Acme Electric Power Company very well. Although you do not always agree with them, you do have a great deal of respect for Acme's leaders. This time you are in agreement with Acme. You recommend approval of permission for Acme to enlarge its storage capacity for spent fuel in the existing pools.

After following the debate over nuclear power for many years, you have determined that the great majority of specialists in nuclear power are satisfied that it is an energy source we can rely upon with reasonable safety. Sure, there's some risk, but you have come to the view that in our highly technical and complicated society, there is no such thing as "zero risk." We have to calculate the risks in everything we do--from walking across the street to building a house. If we look at the amount of risk and weigh it against the alternatives--energy shortages, pollution from coal plants, and so on--nuclear power looks pretty good. It appears to you that our nation will have to depend on nuclear power for the next 20 or 30 years, until large-scale electrical production from alternative energy sources can be developed.

One reason why you believe Acme should be allowed to increase its storage is that the company is honorable and trustworthy. Acme has become very "social minded" and "socially responsible." When you meet people from Acme around the community, in church, business, or other activities, you get a feeling that they are basically competent people who know what they are doing. You think they can be counted on to take every possible safety precaution. After all, their kids live in Riverton too!

Since the Maple Island plant was built, the company has provided information very openly and honestly. They know your paper is eager to report everything that happens out at the plant, good or bad. You have never felt that they tried to hide things from the press or the public. They also have had a good safety record. After all, the plant hasn't exploded yet, and you don't think it ever will.

For these reasons you believe Acme should be allowed to increase its spent-fuel storage capacity at the plant.

N. A. LOWITZ

As the mayor of Riverton, you believe that you have a special responsibility to consider all the information in the Acme Electric Power Company case. After all, the people of Riverton look to you for leadership in such issues.

The first thing you want to point out is that Riverton and the state--and the whole country for that matter--need energy. We are high energy users. Energy means jobs and a good standard of living for the people in this community and throughout the United States. Is anyone ready to give up that high standard of living?

Because of the 1970s shortage of oil and past experience with OPEC control, the United States should try to find dependable alternatives to supply its energy needs. The use of nuclear power is one way this country can become more energy independent. On the other hand, this cannot happen if roadblocks continue to be put in the way of nuclear power. You know that in a few cases where people have voted on the issue of nuclear power, they have not voted to close existing plants.

If Acme Electric Power Company is not allowed to store more spent fuel in its storage pools, the Maple Island plant will be forced to close. That could lead to economic disaster for Riverton. Our community is growing and will need more electricity. Without Maple Island, that electricity will cost a great deal more and will not be as dependable. Growth of the community will come to a halt.

It seems to you that the important thing to remember is that the proposed expansion is not going to last forever. When Acme built the Maple Island plant, they expected to ship spent fuel to a reprocessing facility somewhere else. However, at that time, President Carter felt that reprocessing was dangerous because terrorists could use radioactive wastes to build nuclear weapons. So now Acme, and all the other companies with nuclear plants, are stuck with the spent fuel. The federal government is aware of the problem and is working on the development of a nuclear disposal facility.

You have a great deal of faith in the federal government and believe they will come up with a solution soon. There is little reason to worry about Acme's proposal; after all, the plant has been operating for several years without any trouble. They should be granted permission to install the new storage racks.

O. P. MAREK

You have lived on a farm near Riverton all of your life, except for the four years you spent attending Parkland State University. You think the state and especially the area near Riverton are among the most beautiful parts of our country. Within five miles of Riverton lie nearly 25,000 acres of forest and farmland. Part of the area is a state forest which includes several lakes. There are also a number of archaeological sites in the area; at one site the remains and artifacts of an Indian village are evident. Historic sites, including two which are on the Historical Register of Historic Sites, are also located in the area. More than two million people live within 50 miles of Riverton.

You want to see the environment around Riverton protected and the people happy. Keeping people happy means providing enough electricity to meet their needs. You believe that nuclear generating plants are the safest and cleanest ways of producing that electricity. Increasing the storage capacity of the spent fuel pools at the Maple Island plant would have little or no impact on the environment.

On the other hand, if the certificate of need is denied, Acme will have to use coal and oil to produce electricity for this area. Using coal will mean that large-scale strip mining will destroy vast areas in the western United States. It will also lead to more acid rain. Acid rain, you believe, poses one of the most serious threats to this nation's environmental quality.

M. L. VOSIKA

In 1980 you received a master's degree in nuclear engineering from a major university. During your studies you worked at the university's nuclear reactor laboratory. Since going to work for Acme, you have worked at several engineering jobs related to nuclear plants.

The need to increase the storage of spent fuel in the existing pools at Maple Island has grown because there is nowhere to ship spent fuel. Furthermore, the existing storage capacity will be filled in three years.

Some people who don't want to allow Acme to expand its spent-fuel storage claim that the company should ship its spent fuel elsewhere or build a new storage pool away from the present site. What they don't realize is that shipping spent fuel may actually expose more people to risks of nuclear contamination. The movement of such waste material over public highways is more difficult to control than is storage in a company-operated pool.

Other people are worried about the size of the increase--from 687 spent-fuel assemblies to 1,582 assemblies. These people believe that this increase would lead to greater amounts of nuclear waste from the plant. This is not the case. Actually, the only noticeable effect would be a very slight increase in the plant's reject heat--heat vented to the outside.

Finally, some people argue that the plant should be allowed to expand its storage capacity to some compromise figure. You believe this is not reasonable. The proposed plan can be done within a reasonable time and will provide enough storage for the plant to operate for another 13 years. By this time the federal government will certainly have a disposal facility available. Any plan calling for less storage capacity could cause the plant to shut down sooner or to make further modifications.

You believe the company has proposed the only realistic plan to ensure continued operation of the Maple Island plant and to minimize the risks to Parkland residents.

R. E. BARBEAU

As a lawyer, you are becoming increasingly concerned about the "red tape" that gets in the way of providing energy to the people of this country. This hearing is a good example of the overregulation of industry that slows down progress and costs consumers more and more money each year. Why should Acme have to go through a hearing with the Parkland Department of Energy when it will still need the approval of the U.S. Nuclear Regulatory Commission? How many times does the company have to prove its case?

Acme has always been a responsible and dependable company. There is no reason to believe that the company management would do anything that would threaten the health and safety of the people of Riverton and Parkland. As a matter of fact, the government, not Acme, is responsible for the problem. If they hadn't closed down the reprocessing plants, Acme wouldn't need to expand its storage now.

Acme has taken care to ensure that the increased risks will be very small. First, the company will replace the existing stainless steel storage racks with racks constructed of three-layer material. This material consists of a layer of Boraflex sandwiched between two layers of stainless steel. The Boroflex absorbs neutrons from the spent fuel. The spent fuel assemblies can thus be stored closer together without creating a nuclear reaction in the storage pool.

Second, while the racks are being changed, a steel cover will be installed over the smaller of the two existing pools. This will ensure that equipment and materials are not dropped on the spent fuel in the pool.

Finally, increasing the capacity of the current pools to the maximum gives Acme flexibility in planning for the future. No further increases in storage capacity of these pools will be needed in the future.

You think it should be clear to all concerned that the only answer to this problem is to allow Acme Electric Power Company to go ahead with its plan to expand the spent-fuel storage in the existing pools.

PATRICIA MORNEAU

You are a nuclear physicist at a local university. Several factors about Acme's proposed plan concern you.

Acme must clearly demonstrate that its proposed design will effectively provide for cooling of the fuel rods and avoid an accidental nuclear reaction in the pool.

The fuel removed from a reactor contains some fissionable uranium-235. The fuel contains some plutonium created during it use in the reactor. The density of plutonium and uranium-235 is sufficient to create a critical system (in essence, a reactor) in the fuel pool if the spacing between rods is not correctly chosen.

No one has ever packed spent-fuel assemblies this closely before, so they cannot be sure that a reactor will not be created in the pool. You believe the risks of such an accidental reactor are so great that the Parkland Department of Energy should deny Acme's petition.

A third major concern is the lack of a permanent storage facility. The federal government is currently searching for a site for such a facility, but they have not proven to be especially effective in dealing with this issue in the past. You think that it is possible that a permanent storage facility will not be created for 25 or 30 years. This means that Acme will again be forced to expand its storage of spent fuel as it has already done several times. Now is the time to put a stop to all this. Acme's petition should be denied.

ANDREW WESTPHAL

For more than 10 years you have worked full time researching the hazards of nuclear power plants. As a nuclear reactor physicist and engineer, you have made computer calculations, studied reactor design, and analyzed information developed by government laboratories. You have published many books and articles on the subject of nuclear safety.

You believe that the proposal to increase storage of spent fuel at Acme's Maple Island plant greatly increases the dangers of that plant. The accident hazard of the spent-fuel storage pools is already very great. You are well aware that accidents occur at nuclear power plants more frequently than the public would like to believe. The Three Mile Island accident has, of course, been the most publicized, but there have been many other accidents at nuclear plants over the past few years.

One of the greatest hazards would occur if the spent-fuel pools were to lose water. This could happen through evaporation or through a break in the pool. If the pumps and valves which make up the pool's cooling system broke down, heat given off by the spent fuel would eventually cause the water to boil. The boiling would cause evaporation, leading to a reduction in the pool's water level. As the water level dropped, serious problems would result. When the spent-fuel pool is filled with water, most of the radiation comes from materials in the water itself, rather than from the spent fuel. With a drop in water level, the radiation from the spent fuel would become more significant. For example, there would be ten times more radiation in the spent-fuel pool area with water eight feet above the fuel than there would be with water twenty-three feet above the fuel. Water levels below eight feet would allow a very rapid increase in radioactivity.

If the water level fell far enough to expose half of the length of the spent fuel to air, temperatures would rise to more than 1000° centigrade. At these temperatures zirconium (a nuclear waste material) reacts with steam to produce hydrogen gas. A great amount of radioactivity would build up in the pool building. The hydrogen gas could explode, causing a break in the building and releasing radioactivity to the atmosphere. The more spent fuel in the pool, the more widespread the impact of such an accident.

Of course, no one knows for sure that such an accident will ever happen. But why take the chance? If the Parkland Department of Energy denies Acme permission to expand the spent-fuel storage, the Maple Island plant will be forced to close. That is what you would like to see happen.

H. S. STEIN

You are a professor of public affairs at the University of Parkland. You also have an M.D. degree and a master's degree in nuclear physics. Currently, you are serving as a member of the Peer Review Group of the U.S. Nuclear Regulatory Commission special inquiry into the Three Mile Island accident.

You believe that people must understand that "spent" does not mean that all the uranium and other radioactive materials in the reactor fuel have been used up. On the contrary, spent fuel does not simply fade away. When spent-fuel rods are removed from the reactor, they generate a great deal of heat. They also contain highly radioactive materials--nuclides, uranium, actinides, and plutonium. Plutonium is one of the most toxic and dangerous substances known to modern science. Exposure to even very small amounts can cause death. Furthermore, it remains dangerously radioactive for a long time. The most common type of plutonium (Pu-239) has a half-life of 25,000 years; this means that it takes that long for waste plutonium to lose half of its radioactivity, and another 25,000 years to lose half of what's left, and so on. To be safe, plutonium must be isolated from contact with the environment for about 250,000 years.

Now, Acme Electric Power Company wants to store more and more of this material at the Maple Island plant. You believe this would be a serious mistake. Spent-fuel pools at reactor sites were originally meant to provide places to hold spent fuel for a few weeks or months until it could be sent to reprocessing plants. Acme has already expanded the storage in its pools once; three years ago they expanded the capacity of the pools from 210 fuel assemblies to 678 assemblies. Now, they want to expand the capacity to 1,582 assemblies. You don't believe that the company is being realistic in expecting the federal government to provide safe away-from-reactor (AFR) storage in the near future. Too much is yet to be done before an AFR facility will be developed.

There have been federal programs for the development of a nuclear waste facility for more than 20 years. The program has faced many difficult technical and political problems. Recently, a demonstration facility was planned for the area near Carlsbad, New Mexico. That plan--the Waste Isolation Pilot Plan (WIPP)--was to begin testing in 1988. Now WIPP has been postponed indefinitely. It will be impossible for a demonstration facility to begin testing before 1993, and you think an operating waste facility is not likely to be available until well into the next century.

Since increasing the waste stored at Maple Island would increase risks from the plant, you believe that Acme should not be allowed to expand its storage capacity.

A. J. SOVICH

Your family has lived in a small town near Riverton for four generations. Currently, you are employed there as a printer-journalist. You became interested in the Maple Island plant about seven years ago, before it went into operation. You have studied and written several articles about the issue of nuclear power.

Your study of nuclear energy has led you to conclude that boiling water with heat produced from nuclear reactors is a very dangerous way of producing steam to generate electricity. The continued use of this process will condemn large numbers of our fellow humans to suffering and death from cancer and leukemia. It will also lead to genetic defects among the unborn children of this area. All the people of this area are potential victims of accidental contamination from Maple Island. Acme should not be allowed to expand its storage of spent fuel.

The storage of spent fuel is such a great problem because there is currently no permanent storage or disposal site available. Acme wants to store wastes where they were never intended to be stored. Large amounts of extremely dangerous materials--for example, strontium 90 and plutonium--would be stored at the plant site for decades. These materials, if allowed to escape into the atmosphere, would cause almost unbelievable damage.

Consider how much spent fuel Acme will store at the plant. In a pool designed to hold 210 fuel assemblies, Acme wants to store 1,582. At capacity, the pools would contain more than 50 million curies of strontium 90. In 1957, a government report estimated that release of vapors containing 150 thousand curies could result in serious harm to more than 150 thousand square miles of land. That is an area the size of Illinois, Indiana, Ohio, and half of Pennsylvania. What would happen if 50 million curies got out?

Radioactive materials could escape in many ways--through explosions, accidents, and so on. Since there is no foolproof way of preventing such accidents, the only answer is to stop the use of nuclear energy now.

T. W. POHLMAN

The last three places you have lived--Parkland, Oklahoma, and Virginia--have been faced with problems related to nuclear power. When you left Oklahoma, they were arguing about building a nuclear power plant; here they're talking about waste problems. Since people everywhere seem to be opposed to nuclear power, why do we have it?

As far as you can figure, only 13 percent of all the power in the United States comes from nuclear plants. Plants get closed all the time for maintenance or accidents, and you never hear about people having to go without electricity. There's power to spare.

If everyone would cut back, we would have no need for those nuclear plants. Our cities could cut back; walk outside and count the streetlights. Look at the skyscrapers at night; all those lights don't have to be left on. Look at all the extra stuff that is put up at Christmas time. All of that wastes electricity. If people don't want to live with the threat of a nuclear disaster, they'll just have to learn to cut back. And everyone has to do it. Conservation is the safest and surest way to ensure future energy supplies.

The thing that troubles you the most about Acme's proposal is the uncertainty. No one seems to know what will eventually happen to all the radioactive waste, and you're not only worried about the spent fuel. The way you see it, if they put in new racks, they are going to have to take out the old racks. What is going to happen to the old racks and the other stuff that gets contaminated while replacing them? No one has said a word about that. They could be dumping all that stuff in the ocean for all you know!

One last thing: you have worked in a factory and you know that things break down every so often. And you have taken a tour of the Maple Island plant. There are a lot of things at the plant that can break down--pumps, valves, breakers, switches. People are kidding themselves if they think that Acme can guarantee that nothing will go wrong at the plant. The only guarantee is to close Maple Island; don't let them expand their spent-fuel storage.

M. I. ERICKSON

You are a student at Parkland State University located 30 miles from Riverton. The prospect of storing more and more spent fuel at the Maple Island plant frightens you to death! Your most serious concern is that nobody seems to know exactly what will happen and what the effects might be. With other things--fires, explosions, floods--the disaster happens, people are injured or killed, but then it's over. With a nuclear accident you have to worry about developing cancer years after the accident or about effects on future generations. If the Parkland Department of Energy makes a mistake now, it is possible that it won't be discovered for another generation or two. You don't want to see more spent fuel stored at Maple Island.

Acme's proposal will increase the risks to the environment and to the health and safety of the citizens of Parkland. For example, radioactive air emissions from the plant could be increased. This will mean greater low-level radiation exposure for the people of Riverton and surrounding communities. Although a lot of people claim to know about the health effects of high-level radiation exposure, no one has clearly identified the potential health effects of low-level exposure. Someone must recognize the risks of nuclear power, since you read recently that the government may not allow any new nuclear plants to be built.

In your opinion, Acme Electric Power Company should spend the $4.2 million it would cost to expand the storage capacity on research to develop alternative energy sources. Is this society so shortsighted that no one recognizes the dangers of all this poisonous waste? It is time to turn our attention toward the development of safe, renewable energy sources. If the government would support solar or geothermal power development projects as they have nuclear power, we wouldn't have to worry about having enough energy.

MARIA CHAVEZ

You have owned your own textile distributing company in Riverton for the past 15 years. Acme Electric Power Company's proposal to expand its storage of spent fuel really makes you angry. Since the accident at Three Mile Island and all the publicity about the problems of nuclear power, people have been afraid to buy homes near nuclear plants. You believe that the Maple Island plant is frightening away people who might like to move to Riverton. If the community doesn't grow, your business won't grow.

But what really makes you mad is that Acme wants everyone to believe that the federal government is at fault in this case. All the Acme testimony indicates that the company expected to be able to ship its spent fuel to a reprocessing plant, and now that the government has suspended reprocessing, Acme is stuck. That is not exactly accurate. Three years ago AEPC expanded spent-fuel storage at Maple island from 210 assemblies to the current capacity of 687. The company knew that it would be faced with another shortage of storage capacity in six years. Acme also knew that the federal government did not plan to have a permanent storage facility available before 1989 and that reprocessing was not available. In addition, AEPC was aware that no other spent-fuel storage pools would accept their spent fuel. Nevertheless, the company took no action to prepare for the upcoming shortage of spent-fuel storage space.

At that time Acme knew that they had time to prepare for this problem by building either a separate on-site spent-fuel storage facility or a new off-site storage facility. Acme knew they had to act quickly, but they took no action. They must share the blame for the current problem! As a businessperson, you think this is simply poor planning and bad business.

This poor planning is also evident in the company's forecasted energy needs and impact of conservation programs. If they had any competition, Acme would go out of business. With management like that, you hate to think what will happen with the additional spent fuel stored at Maple Island. The U.S. government should deny Acme permission to expand its storage capacity.

Role Card HR-23

CLARK MARA

As a professor of radiological physics, you are especially concerned about the potential health hazards in expanding storage of spent fuel at Acme's Maple Island plant. You know that exposure to radiation is associated with certain kinds of cancer. Increasing the spent-fuel capacity would result in increased occupational exposure to workers involved in modification of the plant. In addition, radioactive air emissions from the plant would increase. Finally, it is estimated that 15,050 cubic feet of solid waste--for example, the old racks--would result from construction. The increase in radiation would increase the possibility of contamination of workers or of the area surrounding the plant. This is too great a risk to take. Acme should not be allowed to expand its storage of spent fuel.

There are some other potential dangers that have you worried. A total of 121 fuel assemblies are used to run the reactor. If something happens and the reactor needs to be shut down for repairs, these assemblies have to be stored in the spent-fuel pools. The Nuclear Regulatory Commission strongly recommends that unused space be kept in reserve in case such an event ever occurs. This unused space is called a "full core reserve." At the current levels of operation, there will be 602 spent-fuel assemblies in the Maple Island pools in three years. At that time the plant will no longer have a full core reserve. If a shutdown became necessary and the full core could not be stored, repairing the reactor would be difficult or impossible. Storage capacity must be expanded to ensure that a full core reserve is maintained. If the plant were closed now, however, there would be no need for expansion.

Furthermore, shipping spent fuel requires that it be placed in a shipping cask. Putting such a cask into the spent-fuel pool requires a space as large as four 7 x 7 storage racks (49 spent-fuel assemblies). The packaging is handled under water in the smaller pools for safety reasons. However, Acme proposes to store spent fuel in the small pool after 1989. This would mean that spent fuel would be in the pool when the shipping cask is lowered into the pool. If the cask were dropped or slipped sideways and struck the spent fuel, an accident could occur.

The risks are simply too great. Acme should not be allowed to expand its storage capacity for spent fuel.

R. H. HERNANDEZ

As an employee of the Parkland Environmental Control Agency, you are concerned about the potential environmental effects of allowing Acme to expand its spent-fuel storage capacity. This is not the first time the company has increased the capacity of the pools at Maple Island. When the plant opened, the pools were to hold only 210 spent-fuel rods. These rods were originally to be stored at the plant for only 60 to 120 days. Then they were to be sent to a permanent storage facility. No permanent storage facility is available, however, so more and more spent fuel has been stored at the plant. Currently, 687 rods can be stored in the plant's pools. When the company expanded the storage capacity to the current level, your agency expressed concern that Acme would seek further expansion in the future. The company claimed that would not be the case. Now, three years later, Acme wants permission to expand the Maple Island storage capacity from 687 rods to 1,582 rods. You and your agency feel this amount of expansion is too large.

You believe that all the possible alternative courses of action and their potential environmental effects must be carefully considered, and that any action on the company's request for a certificate of need should be postponed until a full environmental impact statement is prepared. This statement would detail all the effects of each possible course of action.

You are requesting a full environmental impact statement because the state Environmental Rights Act calls on your agency to take action in any hearing on an issue which is likely to result in "pollution, impairment, or destruction of the natural resources located within the state."

The proposal to store such a large amount of radioactive waste at Maple Island for an indefinite time could lead to such serious effects as additional emissions of radioactive gases from the plant or an accident involving environmental disaster.

Your agency wants to see:

--A careful, detailed examination of all short-term alternatives to increasing the capacity of Maple Island's spent-fuel pools.

--A detailed study of the safety factors involved in storage of spent fuel at the plant.

--A projection of how soon permanent disposal or off-site storage will be available and a plan of action in case such storage facilities do not become available.

--An explanation of why the storage facility at Maple Island should not be considered a permanent storage facility, since no alternative storage facility is available. (This is important since state law makes it illegal to establish a permanent storage facility for nuclear waste in the state of Parkland.)

Y. C. CHU

The whole question of nuclear waste disposal bugs you. As a long-time resident of Riverton, you'd hate to see anything terrible happen to the community because of a nuclear accident. However, you don't like being tied to foreign sources for fuel and believe nuclear power can help the United States achieve energy independence. So what's to be done?

As a city council member, you know that your opinion will carry greater-than-average weight. You believe the best compromise is allowing Acme Electric Power Company to increase the storage capacity of the spent-fuel pools, but by less than they want. Acme is asking for the new limit to be 1,582 rods; you propose a maximum limit of 1,120. Your figure is far more than the 687 now allowed but also far less than the 1,582 figure. You feel that this solution would increase the risks to the Riverton community less than would Acme's proposal.

Several weeks ago, you had a brief discussion with a representative from Acme. He stated that the utility would not expect to store as many as 1,120 rods at Maple Island until 2990, assuming that the plant continues to consume nuclear fuel at its present rate of roughly 80 rods per year. By that time a national policy on nuclear waste disposal should be in action, with either permanent storage facilities or certified reprocessing plants available. Furthermore, Acme would have enough time to build a new on-site storage facility to ensure that no further expansion of storage in the existing pools would be needed.

The compromise you suggest would allow challenges to be raised if serious safety concerns arise. Under your plan, needed electricity would still be produced and the potential risks would be lower than those under the Acme proposal.

You know that environmental and citizen groups oppose this compromise. They feel that any expansion of the already overloaded spent-fuel pools could endanger human health and pollute the environment. As a long-time politician, you believe that their position, though well intended, is foolish. The likelihood of actually denying Acme's petition is low, the need for cheap electricity being so great. Therefore, some expansion of the spent-fuel pool's capacity appears inevitable. Isn't it better to argue for a realistic moderate risk alternative like yours rather than an unrealistic "zero risk" level like the environmental groups want?

Role Card HR-26

SAM RENSTROM

As a long-time resident of Riverton, you've heard many years of debate about the Maple Island plant. First, there were arguments about building the plant; when accidents occurred, questions were raised about its safety; now the problem of fuel rod storage has come up. You believe these controversies are productive and help Acme Electric Power Company and the public stay in communication with one another. You feel that Acme should be allowed to increase the fuel rod storage pools temporarily. You have several good reasons for taking this, rather than a more extreme, position.

The need for electric power in Parkland is clear. Ever since the 1973 oil embargo the one big issue has become power--where to get it and how much it will cost. The Maple Island plant supplies nearly 30 percent of Acme's available power. To close the plant in these energy-hungry days would be downright ridiculous--especially if it is operating well and storage of the spent fuel rods is the only problem. However, this doesn't mean you don't have some questions that must be resolved in the debate.

One of your favorite energy crisis solutions is conservation. It is a simple, inexpensive way for everyone to work together to solve the energy problem. You read somewhere that good conservation measures could save vast amounts of the energy now consumed. Couldn't we work towards such a goal so that the Maple Island plant could be safely shut down if it became necessary at some time? You've seen the foot-high stack of reports on why Acme should be allowed to increase the number of spent-fuel rods kept in the existing storage pools. Imagine what could be done if that much money and brainpower were devoted to promoting good conservation measures.

You therefore support allowing Acme to temporarily increase the storage capacity for spent fuel rods. If no solution to this problem is reached within five years, the plant should be shut down. You are reasonable, but not blind to the dangers inherent in piling up all those radioactive fuel rods. The real answer is conservation anyway!

SHARRYL MILLER

The question of what to do about the spent radioactive fuel rods from the Maple Island plant really has you upset. Here you sit in a small Parkland community arguing an issue that more rightly belongs in Washington, D.C. The way you see it, there really is no question that the storage capacity of the spent-fuel pools must be increased--BUT ONLY TEMPORARILY. A realistic and permanent solution to this problem is needed soon. If nuclear power is part of a national energy program then the problem of nuclear waste should be solved at the national level. Small towns like Riverton shouldn't have to accept the dangers that an uncertain nuclear waste policy produces.

You know that the federal government passed a bill in 1980 called the Nuclear Waste Policy Act. However, the act only says that permanent waste disposal sites should be established in "the future." Your position is that Acme's request to expand its on-site storage of spent fuel rods should be granted for a maximum of five years. An absolute deadline will help put pressure on the federal government to establish permanent nuclear waste disposal sites. About the dangers of radiation, accidents, and foul-ups related to Acme's new storage plan you have no doubt. You and your family, however, will sleep more soundly if you know a certain solution is down the road.

Actually, your anger on this issue is not directed at Acme. They built the power plant believing that a national policy for nuclear wastes would be available. The spent fuel rods were originally to be sent elsewhere to be reprocessed. Since the major risk of reprocessing is the theft of weapons-grade plutonium, you see a silver lining in this situation. The move away from reprocessing toward permanent storage of nuclear wastes seems safer. Since several hundred people in the world today could build a crude atomic bomb using only the stolen plutonium and a chemical laboratory, you're glad to wait a few years to establish a strong permanent storage program. Trade-offs exist everywhere; here it is a safer world in the long run for a greater risk to Riverton in the short run.

ANDREW BADEN

For the past five years you have been conducting research on radioactivity as part of your studies to obtain a Ph.D. in physics. You love the importance of your chosen field--it seems that nuclear power will be with us for a while and you'll be one of the experts on the subject of dangerous radiation caused in the fission process. You have a special interest in the Maple Island power plant controversy because you spent many summers as a child camping and canoeing in the Riverton area. You hope, in the back of your mind, that after you're married your kids can have fun exploring the same forests and rivers you enjoyed. Your position on the petition is that the storage capacity of the spent-fuel pools should be expanded, but only with special precautions.

Accidents are always possible when technology reaches the complexity found in a nuclear power plant. No matter now careful the human operators are, no plant is 100-percent risk-free. Although the likelihood of a serious accident is generally agreed to be quite low, the impact of an accident would probably be extremely widespread. Great caution must be taken at all times! Never before have so many spent fuel rods been placed as close as will be done if Acme's request is granted. Scientists just aren't sure how safe such an arrangement will be. Therefore, you insist that any expansion of storage capacity be combined with an extensive testing and monitoring program. Special instruments and specially selected and trained staff should monitor the spent-fuel pools 24 hours a day, 365 days a year. Any unexplained rise in temperature or decrease in the water level in the pools should be carefully watched and dealt with. A detailed set of emergency procedures should be created. To your way of thinking the situation is very logical: increasing the spent-fuel storage capacity increases the risk of a serious accident occurring; thus, much greater caution is needed.

You feel one other point is very important. Some sort of long-term solution for the problem of disposal of spent fuel rods is needed. You could not, in good conscience, accept another request for expansion in another five years. The risks would just be too great. Either we solve this problem or we start shutting down the nuclear power plants. This is hard for you to say because it might mean harming your future. However, the dangers to society as a whole are more important than the loss of your job.

M. S. KINWOSKI

You're a 34-year-old businessperson who likes to think that you look at problems in a straight-on, no-nonsense fashion. When a problem arises at home, you look at its causes, examine the various alternative solutions, and make the best decision. You recognize that the best decision is often not the most popular decision. As a businessperson, you also recognize that there are uncertain realities that are sometimes distasteful--but important nonetheless.

Nuclear power is one such reality. You believe that any person who expresses an unquestioning love for nuclear power is an idiot or a fool. No matter what anyone says about the low probabilities of accidents, nuclear power has too many risks to make it a lovely energy alternative. However, as a businessperson, you know that electricity is vital to the nation's economy--and nearly 30 percent of Acme Electric Power Company's generation comes from nuclear sources. Thus, you take a compromise position on the request to expand the storage capacity at Maple Island's spent-fuel pools. You recognize the need to store the spent rods so the plant can keep operating, but believe that new storage pools should be constructed away from the immediate plant site.

The big issue here is spacing--the distance from the reactor to the spent rods and the distance between the spent rods inside the pools. If the rods are too close to each other in the pools, enough heat can build up to start a new nuclear reaction in the relatively unprotected pools. If such a thing occurred near the actual reactor building, who knows what awful things could happen? Therefore, move the storage pools away from the actual reactor building for greater safety.

Moving the pools away from the reactor would not cause major transportation problems. You've seen films showing containers used for carrying radioactive products survive direct hits by a speeding locomotive. Since the movement would be on the general plant site and not through any populated areas, the risks of transporting the spent fuel rods to new storage pools would be minimal.

You are a realist. Parkland needs electricity and the Maple Island plant supplies a lot of it. Shutting down the plant because of the storage problem is irresponsible and would cause many people to suffer economically. Expanding the storage capacity as you suggest will cost money but be well worth the lowered risk of serious accident or radiation leakage.

ANNE G. JEFFERSON

Your area of expertise is nuclear engineering. You are 47 years old and were one of the few women in your graduating class. Over the years, you have made quite a name for yourself and have served on several presidential commissions looking into nuclear power. If someone asked, you couldn't definitely say whether you are strongly for or against nuclear power. You believe that nuclear power must have a place in our nation's energy policy, but only if it is proven safe and as relatively risk-free as other energy sources. As an expert in the field, you know better than anyone the horrors that a nuclear accident could cause. You hope that any such accident can be avoided at the Maple Island plant. You believe that, rather than increasing the storage capacity in the present spent-fuel pools, additional pools should be built on the plant site. Closing the plant because of the storage problem would make little sense, since the reactor itself has been shown to be operating safely.

The spent-fuel pools were originally designed to provide short-term storage of 210 spent rods. In the yearly refueling process, roughly 40 of the reactor's 120 rods were to be replaced and stored in the pools until they were transferred to a reprocessing facility. The pools were designed for the safest possible storage of no more than 210 fuel rods. Recently, however, the capacity of the pools was boosted to 687 rods because no reprocessing plant yet exists. Spent rods are in almost permanent storage in the pools. The present request by Acme Electric Power Company is to further boost the pools' capacity to 1,582 rods. The risks of placing this many rods in pools originally designed to hold only 210 rods are unknown.

You believe safety, not costs, should be the major consideration in this debate. There is little doubt that Acme will have to again request an increase in storage capacity or face shutting down the plant in the future. Thus, new storage pools should be built on the plant site to handle the present and near-future excess spent fuel rods. Some have said that Maple Island's spent rods should be transported to other facilities with excess storage capacity. Doesn't it make more sense to avoid the risks of transporting radioactive materials many miles by building new spent-fuel pools at Maple Island?

All sides in this debate, once it is resolved, must work together to create a permanent solution to the nuclear waste disposal problem. It is this problem that makes you wonder about nuclear power's safety. What is needed is a low-risk answer to piling up spent fuel rods in each reactor's backyard.

ACTIVITY 2
DESIGNER GENES: CONTROL OF RECOMBINANT DNA RESEARCH

OVERVIEW:

"Designer Genes" involves the continuing debates over regulation of recombinant DNA (recDNA) research. The case is based on the landmark case in Cambridge, Massachusetts, in the 1970s but has been relocated in the fictional community of Covington. The role play was fictionalized because developments after the 1976 debate in Cambridge, particularly the 1977 efforts to loosen the National Institute of Health guidelines and the resulting Congressional hearings, are important for students to consider. However, the Cambridge documents still provide an excellent source of historical data for the Covington City Council decision makers. For specific information about the Cambridge case, see the Teacher Information section following procedure (p. 154).

Students are assigned roles representing Covington City Council members, Covington residents holding various views regarding recDNA research, and other interested individuals. The students participate in a simulated Covington City Council hearing to present arguments for three basic alternatives:

--Leaving regulation of recDNA research to scientists engaged in such research, thus excluding lay community members from the regulatory process.

--Placing regulatory powers in the hands of community members only.

--Creating a joint regulatory body of scientists and lay community members to regulate recDNA research in Covington. The council may decide whether scientists or lay community members would comprise a majority on this regulatory board.

Students are divided into groups representing each of the above positions as well as a decision-making group, the Covington City Council. Through several days of library and community research, the groups compile evidence to support their respective positions. To facilitate the research component of this activity, each group contributes the information they have compiled to a classroom resource center where all participants can obtain equal access to the information.

In the culminating exercise for this activity, the three advocacy groups present their arguments, supported by their research data, at an open meeting of the Covington City Council. Following the open meeting, the city council must reach a majority decision on the recDNA issue. A discussion analyzing the different viewpoints and the decision-making and risk-management processes concludes the activity.

OBJECTIVES:

After participating in "Designer Genes," students will be able to:

1. Explain and discuss the social, political, and economic factors that influence decisions made on public policy issues of science and technology.

2. Identify and describe the central conflict involved in a problem requiring social action and decision making.

3. Clearly state the interests and values involved in a problem situation.

4. Systematically analyze the risks in a problem situation and consider ways to minimize those risks. For example: What are the potential negative effects (risks)? Of what magnitude are the potential effects? What is the probability of the occurrence of these effects? In considering alternative courses of action, students will identify the costs and benefits of each alternative.

5. Identify or state alternative solutions to a problem situation.

6. Identify and analyze the probable consequences of particular courses of action.

GRADE LEVEL: 9-12

TIME: Approximately 7 class periods, as outlined in Handout 2b, "Activity Timeline."

MATERIALS: 30 role cards

Handouts. Reproduce as indicated.

2a: Background Notes: The History of Recombinant DNA Research (1 per person)
2b: Designer Genes Activity Timeline (1 per group)
2c: Instructions to Group Leaders (1 per group)
2d: Risk Assessment (1 per group)
2e: Press Release (1 for Covington City Council Group)
2f: Designer Genes Group Worksheet (1 per advocacy group)
2g: Covington City Council Group Worksheet (1 to council group)
2h: Suggested Resources on DNA Research (1 per class member)
2i: How to Run a City Council Meeting (1 per council member)
2j: Designer Genes Data Packet (1 per group)

PROCEDURE:

A. On the day before beginning the activity, take 15-20 minutes to introduce some general issues surrounding controversies over scientific research. Discussion can be organized around the following questions:

--Is scientific research "good" or "bad"? Is it neutral? Explain your answers.

--Should any kinds of experiments be banned in our society? What kinds and why?

--Are scientists responsible for the ultimate use of the findings and products which result from their research?

--Can, or should, citizens control scientific research? Why or why not?

B. Assign Handout 2b, "Background Notes," as a homework reading. To structure the reading, divide students into "pro" and "con" groups. While reading, students should compile a sheet of DNA research facts and major arguments for their sides, either pro or con. Note that the material in the "Background Notes" is critical for providing the basic information necessary to participate fully in this activity. Teachers too should read this carefully.

Day 1: Introduction

A. Use the information in the "Background Notes" for a brief presentation introducing the general question of recDNA research. Using the information compiled by students in their homework reading, make a recDNA fact sheet on the blackboard.

B. Introduce the specifics of the role-play situation and the decision-making steps outlined in "Conceptual Basis for CREST" (pp 3-7).

C. Assign and distribute a role card to each student and divide the class into the following four groups.* Allow 15 minutes for students to read their cards and introduce themselves to their group.

Regulation by Scientists Group	Joint Regulation Group
A.J. Crespin	Dr. A. Salvatore
Manfred Schliva	E.M. Buna
Anita Ramirez	Stanley White
William Wyatt	A. Herrera
C.A. Zacharian	Dr. Kathy Baus
J.D. Green	Rev. Jack Fitzpatrick
A.F. Hassan	R. Znamenacek
Robert Manke	Dr. Sheila Burke

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*If the class has fewer than 30 students, the same relative size should be maintained for each group. The unused roles should be added to the data packets of the appropriate groups since the information in them is important for the group to consider. In larger classes, students can work in pairs on single roles. Roles with initials can be enacted as either males or females.

Regulation by Lay Community Members Group

Peter Nightingale
P. Highwater
Anthony Dominicki
W.S. Chin
Bruce Scotland
Dr. D.E. Nguyen
Frieda Schmitz

Covington City Council

Mayor Guiseppe Valardi
David Stern
Tim Novak
Juanita Carlos
R.J. Potrowski
D.N. Pirnak
Robert Thornstein

D. Distribute to each group a copy of Handout 2b, "Activity Timeline," and quickly review its contents. Identify one or two leaders for each group. They will be responsible for ensuring that their group attends to its tasks. Each group leader should receive a copy of Handout 2c, "Instructions to Group Leaders."

E. The initial group task is to begin to assess the risks involved in recDNA research. Students should use information from the group members' role cards. The questions on Handout 2d, "Risk Assessment," should be used to guide discussion in each group. The teacher should circulate from group to group, helping students respond to the questions on Handout 2d.

F. (Optional) As homework, students should become completely familiar with the information in their role cards.

Day 2: Preliminary Hearing and Intragroup Discussions

A. As a class, spend 5 minutes reviewing the information compiled on Handout 2d, "Risk Assessment."

B. Using the "Risk Assessment" as a guide, the Covington City Council group conducts a brief (approximately 15 minutes) preliminary class-wide meeting focused on the following questions:

--What are the potential negative effects of recDNA research?

--How extensive will these effects be?

--How likely is it that these effects will occur?

Remind the city council that at this point everyone is operating with very little data. There will be some disagreement about the potential risks, especially the magnitude and the probability of their occurrence. In trying to assess the potential risks, the city council might focus on the worst that could happen and identify the various positions on how likely it is that it will happen. Discussion should be kept to a minimum. More extensive discussion of the risks will take place on Day 6, the Covington City Council Meeting.

C. Following the preliminary meeting, the city council prepares a news release on Handout 2e, "Press Release." Reproduce and distribute this news release to the other groups.

After completing the news release, the Covington City Council should begin to consider the alternative courses of action provided on Handout 2g, "Covington City Council Group Worksheet." The group should identify important questions related to each alternative for use in guiding the discussion during the city council meeting.

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While the city council group is preparing the news release, the three advocacy groups complete Parts I and II of Handout 2f, "Designer Genes Group Worksheet." This is the first step in preparation for making presentations on their positions during the city council meeting on Day 6. Each group should identify their proposed courses of action and discuss reasons for their positions. The reasons should be listed in the left-hand column of the worksheet. Group leaders should see that each group member identifies at least one reason for that group's position. Careful reading of the role cards will facilitate this process.

The following are some of the key arguments that can be made by each of the three advocacy groups in "Designer Genes." Students can find many of these arguments set forth in the "Background Notes" and in their role cards. During research on Days 3 and 4, groups will seek specific supporting data for the arguments they choose.

Regulation by Scientists

--The great potential of the research for solving the ills that plague human society should be stressed. Diseases like sickle-cell anemia may be cured; diabetics can be assured of cheaper, guaranteed, safer supplies of insulin.

--The benefits that relatively unregulated scientific research has brought to humans (for example, wonder drugs and new materials) can be pointed out.

--Arguments regarding the economic benefit of this research to Harrington University, and thus Covington, can be made; successfully exploited recDNA research will provide technical jobs and more federal research dollars, thus adding to the economic base of Covington.

--This group should stress the fact that many of them live and raise families in Covington. They do not want to jeopardize their own lives. As scientists they are in the best position to make sure accidents don't happen.

Regulation by Lay Citizens

--This group should initially stress the issue of "local control." As the community most directly facing risks from recDNA research, they should regulate it.

--The previous disasters with unregulated scientific research should be pointed out; examples include PCBs, the atomic industry, and the spread of dangerous pesticides.

--Research should focus on preventing such diseases as diabetes, not simply providing more insulin. RecDNA is simply another technical fix for deeper problems. Technical fixes tend to create nearly as many problems as they seek to resolve.

--The problem of self-regulation: people directly involved in activities generally have difficulty trying to regulate those activities.

--The fact that many prominent scientists reject recDNA as an important lab procedure is also important and speaks to impartial citizens' acting as regulators.

--The argument that concerned citizens can act as regulators without knowing everything there is to know about microbiology is supported by the fact that Congressional representatives on technical matters are able to make decisions of quality and substance without becoming experts.

--While the likelihood of a research accident may be slight, the magnitude could be enormous.

Joint Regulation by Scientists and Lay Citizens

--Members should present evidence that recDNA research is not all that risky and could have great potential for solving problems facing human society.

--Present the economic benefits of successful recDNA research being conducted at Harrington University.

--A key position of this compromise group is that regulation would demand technical expertise and scientists would provide this. However, sensitivity to local concerns and fears is also important. Citizen participation would ensure no undue risk to residents of Covington. Joint involvement would add a system of checks and balances in the regulatory process.

--The arguments for the other two groups are valid for this group's presentation, which can be enlightened by a spirit of compromise and shared responsibility for the secure future of Covington.

Day 3-4: Research: Preparation for City Council Meeting

NOTE: A major component of this activity is to involve the students in research on the topic of recombinant DNA and related biomedical research. In this phase, each group of students will be responsible for locating information from a variety of sources to support its position on the recDNA issue. Each group will collect one piece of information per person which they will use to support their arguments. Students will share these materials with the rest of the class through a classroom resource center on Day 5.

Ideally, the teacher will be able to photocopy collected materials for inclusion in the resource center. If this is not possible, students should check out materials for classroom use.

A list of suggested resources is provided in Handout 2h. Not all of these resources may be available to all schools and communities. Students should be encouraged to consult the local library as well as the school library, to contact local organizations, and to look for information on this topic relevant to their own state.

Also distribute to each group a copy of Handout 2j, "Designer Genes Data Packet," which contains specific background information. This packet should complement, but not substitute for, student research.

A. The Covington City Council will use Part II of Handout 2g as a guide to their research. Council members must identify important questions for each alternative course of action, locate information related to these questions in a library or other resources, and record the references on their worksheets. This process will help them prepare for the city council meeting. To question each of the groups after their presentations at the meeting, city council members must have a clear understanding of all the information collected through research. In addition, the council members should study Handout 2i, "How to Run a City Council Meeting."

B. While the Covington City Council is conducting its research, the other three groups complete Handout 2f, "Designer Genes Group Worksheet," in preparation for the city council meeting. This will require members to find information to support the reasons they outlined on Day 2 for their positions.

Teachers should emphasize that the quality of each group's presentation, and ultimately its influence on the final decision, will depend on how rigorously each group conducts its research, how carefully it selects relevant data, and how clearly it communicates this information during the city council meeting.

Day 5: Research Sharing

A. To ensure that all groups have equal access to information, Day 5 is designed as a resource sharing day. All materials compiled by all groups are to be made available in a classroom resource center. Tables at the back of the room or a cardboard box with file folders can serve as the resource center. Each group should spend the first half of class looking at materials compiled by others. Instruct students to make notes of how these new materials might affect their own evidence, how to counter opposing or conflicting material with their own evidence, and so on. The city council group AND THE TEACHER should be very careful to become familiar with all the evidence compiled.

B. In the second half of class, the three advocacy groups should go through their group worksheets and prepare their arguments for the hearing to take place on Day 6. Each group will discuss how its presentation will be made. They will each pick a spokesperson and three witnesses to present at the hearing on Day 6. The spokesperson for each group will prepare to present the main arguments and supporting evidence, and each witness will be responsible for adding some new perspective and information. The witnesses should not simply repeat the same points made by the spokesperson. Remaining group members will act as prompters during the hearing and thus should be confident of all procedure.

C. The city council group will spend this time studying Handout 2i, "How to Run a City Council Meeting." The city council should also review all evidence in the classroom resource center in order to be able to respond to all groups during the council meeting. At the end of Day 5, each of the four groups should be fully prepared for the Covington City Council meeting.

Day 6: Covington City Council Meeting

A. The city council conducts an open meeting according to the schedule which is outlined on Handout 2i, "How to Run a City Council Meeting." The group advocating regulation by scientists should make its presentation first. The spokesperson briefly presents the major arguments; three witnesses present additional points. They should all refer to specific resources when supporting their arguments. Following each presentation, the city council should take several minutes to question the group to clarify its position. This pattern should be repeated for the joint-regulation and the regulation-by-lay-community-members groups. During the meeting, the city council should use the questions they identified earlier to guide discussion. They should also ask each group for information on the costs and benefits of their proposed course of action. Part III of the "Covington City Council Group Worksheet" will be useful for this purpose.

B. After all three presentations have been made, an open question-and-answer session should be held.

C. When discussion is completed, allow each group 2 minutes to gather and plan a 1-minute final remark, to be presented by the group spokesperson. Final remarks should be presented in the same order as the initial arguments.

D. The council holds a brief (5 minutes) private discussion in which they reach a decision on the issue. The council announces its decision to the other groups.

Day 7: Final Discussion (Debriefing)

This phase is crucial in helping students recognize what steps they have followed in the risk-management/decision-making process.

A. Each group should spend 5-10 minutes discussing how the city council's decision will affect the group members and the community.

B. The teacher holds a brief discussion to identify ways the decision will affect different individuals.

C. The teacher should have the class turn its attention to some of the key issues in the case. The following questions can be used to help guide the discussion:

--How much did you value the comments of the scientists as opposed to those of the lay citizens?

--What are the major benefits and disadvantages of recDNA research for Covington? For society in general?

--Do you feel that society should be able to control the direction of scientific research?

--Who would have to bear the responsibility if a "bio-accident" occurred in Covington?

--Does the prospect of human genetic engineering concern you?

--Is all scientific research neutral? Good? Bad? What examples could you think of for each of these descriptions?

--Which pieces of information in the data packets were most convincing? Least convincing? Why?

--Ultimately, what, if any, controls should exist over the areas of science and technology?

D. Finally, the class should consider carefully the decision-making and risk-management process, using the following questions:

--Did all groups recognize the same risks? Why or why not?

--Were there any risks on which everyone agreed? What evidence was used to identify these risks?

--Which risks were seen as most serious? Why? Which were seen as least serious? Why?

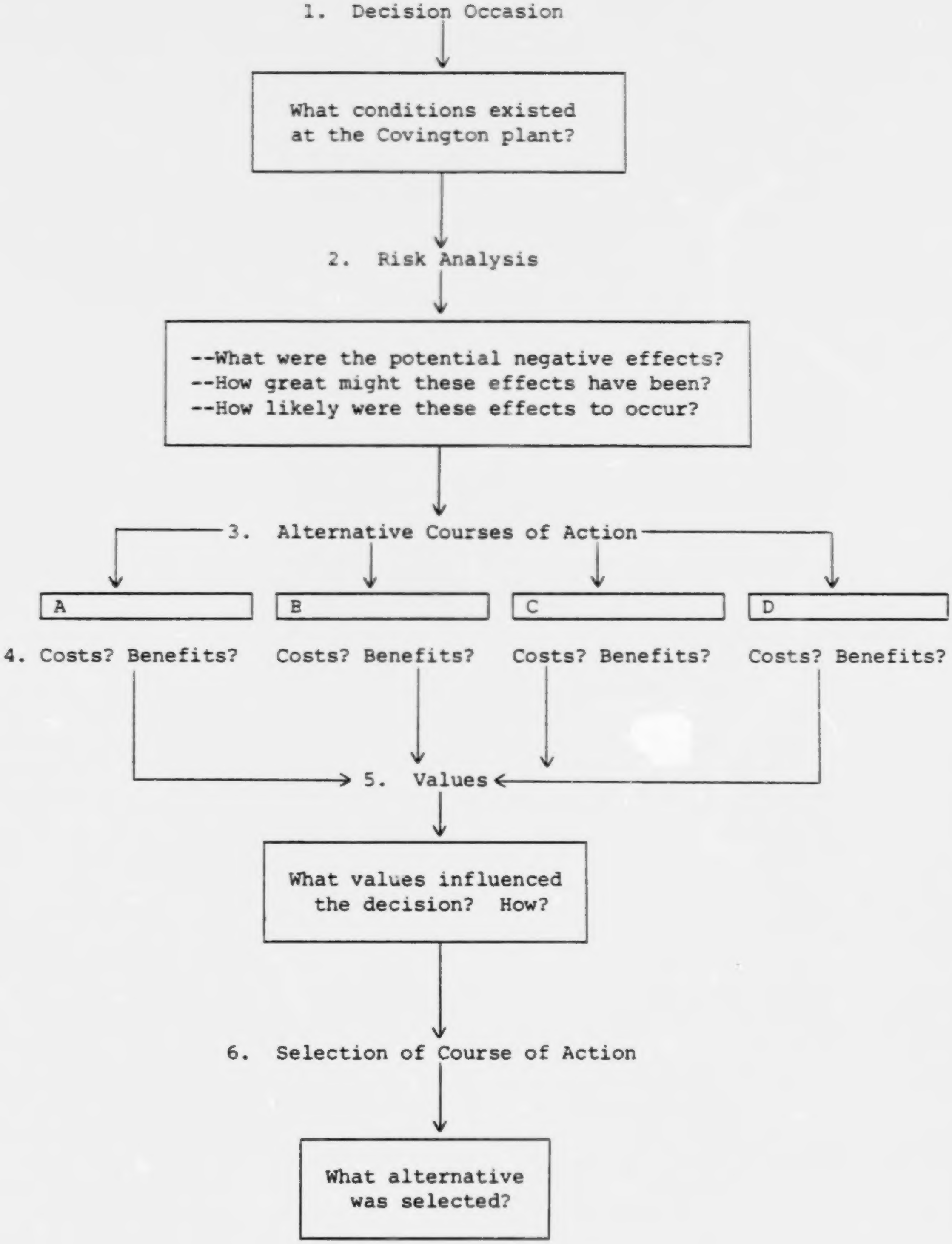
--Who (for example, residents, employees) faced the risks? Did they voluntarily face these risks?

--Do you think it is fair for businesses or government to create risks for people without their knowledge or approval? Why or why not?

--What values influenced the positions held by the different groups? How did these values affect the conflict over the recDNA case?

--What role did technology play in the recDNA conflict? Did it help create the problem? Add to it? Help resolve it? Explain your answer.

E. Now turn the students' attention to the decision-making process. Have them review the six decision-making steps followed in this activity. Then use the framework below to review the process they followed in the case. As they answer the questions, you should fill in the framework on the chalkboard. This page may also be reproduced and assigned as homework at the end of Day 6.


1. Decision Occasion
What conditions existed at the Covington plant?
2. Risk Analysis
--What were the potential negative effects?
--How great might these effects have been?
--How likely were these effects to occur?
3. Alternative Courses of Action
A
B
C
D
4. Costs? Benefits?
Costs? Benefits?
Costs? Benefits?
Costs? Benefits?
5. Values
What values influenced the decision? How?
6. Selection of Course of Action
What alternative was selected?

Ask the students to match the six decision-making steps with the six parts of the framework above. The following is a brief description of how they should match up:

Decision Making	Risk Management Framework
Defining the Issue	1. Decision Occasion 2. Risk Analysis
Recognizing Interests and Values	5. Values
Identifying Alternatives	3. Alternative Courses of Action
Locating and Using Information	All
Probable Consequences	4. Costs and Benefits
Selecting Course of Action	6. Selection of Course of Action

F. To provide closure to the simulation, go around the room having students complete one of the following sentences:

"I learned . . . "

"I still want to know . . . "

"If asked to vote on this issue in our town, I . . . "

TEACHER INFORMATION:

The actual Cambridge controversy illustrated that recDNA research was too "hot" an issue for scientists to keep to themselves. The controversy was born in May 1975, when Harvard University proposed construction of a P-3 level containment facility for recDNA research on the fourth floor of the Harvard Biological Laboratory building. P-3 refers to measures necessary to insure moderate-level safety and security, such as controls against release of microorganisms, limited access, and special measures in storage and waste disposal. Physical containment safety precautions range from P-1, standard laboratory procedure, to P-4, featuring maximum safety and containment controls. The discussion within the Harvard faculty split the ranks of many liberal scientists. Directly concerned were those scientists who were ready to start the research and had offices in the BioLab at Harvard and those at MIT, where a P-3 lab already existed. Other scientists in these buildings, wary of recombinant DNA research risks, quickly opposed the new construction and began developing scientific arguments detailing the risks of the research.

At Cambridge, concerns surrounding recDNA began as specific worries about the proposed location of the laboratory. Soon, ethical and social objections were raised. The BioLab building at Harvard had a bad cockroach problem and a severe infestation of Pharoah's ants that had survived all efforts at eradication. A widely aired concern was that these insects could violate the security of a P-3 lab and spread recDNA organisms into the surrounding environment. The building, which also had a history of electrical fires and broken water pipes, was located in a heavily populated area and in a flood plain. Critics contended that this was a horrible spot for a P-3 laboratory and that the laboratory should be built elsewhere, if at all. Proponents responded by claiming that the risks involved in the research were too slight to create the "overwhelming inconvenience" of relocating the lab farther from campus.

The controversy hit the public arena after Cambridge Mayor Alfred Vellucci read about the proposed laboratory in a June 8, 1976, article in the Boston Phoenix. Vellucci, long at odds with Harvard, had not been informed about the proposed laboratory and immediately won a 9-0 vote in the city council to hold public hearings on the matter. Letters from scientists around the country challenged this action, but Vellucci responded that it was about time that scientists using public funds face public scrutiny on issues related to research safety and other concerns.

Heavily publicized public hearings were held before the city council on June 23 and July 7, 1976. Relevant issues were raised by scientists from MIT and Harvard and by other figures from around the country. Vellucci proposed a two-year ban on all recDNA experiments; this proposal was defeated. City counselor David Clems' motion for a three-month "good faith" moratorium on P-3 and P-4 level research passed by a 5-4 vote. The resolution stated that during this moratorium a citizen review board was to be established to evaluate concerns posed by Harvard's original lab proposal and to recommend an appropriate city policy. The panel was comprised of local residents, none of whom was a biologist. The panel's mandate was limited to investigating health and safety concerns, not the broader implications of recDNA research.

The board, known as the Cambridge Experimentation Review Board (CERB), took 75 hours of hearings to inform themselves on recDNA issues and finally, on January 5, 1977, announced their decision--the first decision by a local public body on recDNA. CERB decided that the benefits of recDNA research were uncertain but possible and that absolute assurances of safety were unreasonable. In essence, the board decided to accept a risk even with vague benefits but did insist that all research be conducted in accordance with National Institute of Health guidelines. The guidelines were to be further strengthened by a more precise health-monitoring system and more public participation in Institutional Biohazards Committees (IBC). The board also established a Cambridge Biohazards Committee of citizens to oversee the Harvard and MIT IBCs. Research at the P-4 level, never proposed by Harvard, was to be banned. Federal legislative attention was recommended before future P-4 experimentation proceeded. The board extended mandatory compliance with NIH guidelines to all recombinant DNA research in Cambridge, whether publicly or privately funded.

These recommendations were accepted by the city council in February 1977. Thus, recDNA work continued, but under more-stringent control and with the informed consent and approval of the local citizenry. CERB demonstrated that a predominantly lay group could face and digest technical scientific information and research a decision regarding its risks and benefits. It also revealed some limitations of such a citizen forum. The debate was still basically between two scientific camps who dominated the controversy's tone and direction. Broader questions about the implications of the research were carved out of the policy debate. In the end, expediency and reasonableness seemed to prevail.

Since the role play was written, much has occurred in the field of recDNA research. The Supreme Court has allowed the issuance of a patent on a recombined organism, significant breakthroughs have been made in the use of recDNA to produce a hoped-for cancer cure called interferon, and many millions of dollars have been invested in recDNA laboratories. Suring this same period, there has been a major move toward relaxing the recDNA research safety guidelines. Many benefits are presently being reaped from recDNA, but the fears regarding its use have not been resolved.

Much of the information in this brief background is based on the following book, which could prove useful as a source of additional information: Nicholas Wade, The Ultimate Experiment: Manmade Evolution. New York: Walker and Company, 1979.

Handout 2a: BACKGROUND NOTES: THE HISTORY OF RECOMBINANT DNA RESEARCH

The question of manipulating the genetic code of lower life forms, such as bacteria, and higher forms, such as animals and ultimately humans, occupies a prominent place in discussions of science, technology, and public policy. Scientists have developed the skills and tools to transfer DNA (deoxyribonucleic acid) from one organism to another regardless of previous natural genetic barriers, barriers that have evolved over countless years. Some have seen this advance as opening the door to a cure for cancer, solving the world food and energy crises, and freeing humankind from genetic diseases. Others see the possibility of recombinant DNA research leading to genetic engineering as envisioned by Adolf Hitler, the creation of new diseases and cancers for which there is no cure, social "engineering," and Andromeda Strain scenarios. The reality is somewhere between these two extremes. Since the early debates, recDNA has become almost commonplace as a laboratory procedure. Many of the early hopes for recDNA are in the process of being realized, yet some scientists and lay citizens still question the usefulness and safety of the process. This background statement and the role-play activity focus on the early controversy and other related issues.

The technology under question is known as "recombinant DNA" or recDNA. DNA is a substance that carries, in a cell, the chemical message we call heredity. The small segments of DNA that instruct cells to function in one way or another are called genes. DNA is a string of genes, all of which command cells in different ways. Genes in DNA regulate certain cells to reproduce and function as skin, others to function as brain cells. DNA instructs cells to assemble amino acids into proteins, which make up important bodily substances including all enzymes, hemoglobin, insulin, and other such hormones. In essence, DNA carries all of the genetic information that makes a human a human or a frog a frog. Finally, DNA has the ability to split in half and exactly reproduce itself in the daughter cell. Thus, the genetic code is passed on in generation after generation of cells. Until recently, the only changes within a cell were the accidental mutations that occur randomly throughout nature.

In 1971, microbiologists announced the potential ability to alter this natural process. Thus was born the technology of recDNA. At its simplest, recDNA is the chemical stitching of a small section of genes from the DNA of one cell into the DNA of a second cell. Once "recombined," the new DNA reproduces itself and the "foreign" section of genes. These recDNA techniques were finally successfully used in late 1973 and early 1974.

RecDNA is generally performed on small ring-like sections of DNA within a cell called "plasimids." With the proper new section of genes, a bacterium cell can be "instructed" to produce new proteins, such as the protein that is insulin. The bulk of recDNA experiments are performed using Escherichia coli or E. coli, a bacterium which lives in the human intestine and which scientists have been studying for years. Use of this bacterium has been an ongoing issue among recDNA researchers and their critics.

The ability to recombine DNA raised many concerns in both the scientific and lay communities. Various risks and benefits have been attached to the ability to perform recDNA experiments. Proponents of recDNA see continuation of recDNA research as a fundamental right related to the freedom of scientific inquiry. Many researchers contend that the pursuit of pure scientific knowledge must not be constrained by any regulatory arm of the government or the public. The scientist has an obligation to investigate unknown phenomena and increase the general fund of scientific knowledge. How this knowledge is used by society is a question for the public and politicians to decide. Knowledge by itself is neutral. It is in the application of the knowledge that value questions arise and policy decisions are made. This, many feel, has little connection with the quest for pure information undertaken in scientific laboratories.

Recombinant DNA research has also been seen as providing a significant tool for the betterment of the human condition. Using the recDNA technique scientists synthesized a growth hormone, somatostatin, at approximately one-tenth the previous cost and hope to soon create bacteria that can manufacture an unlimited quantity of a pure form of human insulin. What recDNA offers is nearly limitless access to exceedingly rare proteins that can do amazing things. RecDNA, it has been claimed, could also create plants that "fix" their own nitrogen in the soil and thus would not need expensive petrochemical fertilizers. Another potential product is a bacterium that literally eats oil from oil spills and turns it into harmless proteins. Bacteria that produce methane could perhaps be created. Such genetic diseases as sickle-cell anemia might also be cured by replacing the damaged gene that causes the disease using recDNA procedures. Obviously, the potential for recDNA has been seen as limitless.

Proponents of recDNA have claimed that the procedures are not overly risky and limits should not be placed on the research. They point to the existence of government safety guidelines developed by the National Institute of Health (NIH) that are, if anything, too strict. Safe labs can be constructed to provide physical containment. Research takes place on specifically designed bacteria that have extreme difficulty surviving outside the laboratory, providing a form of biological containment. Health hazards to the community and society as a whole are felt to be negligible. As for human genetic engineering, pro-recDNA groups assert that no realistic threat exists. We are far from the understanding and ability to recombine human DNA. In addition, sociopolitical structures exist to limit that from ever occurring.

Critics of recDNA contend that the potential risks of recDNA are great enough to invalidate the elusive benefits. Many have reflected the ideas of Dr. Ethan Singer, who called recDNA a tool to achieve certain ends, but a dangerous tool that is not needed. They see recDNA as a short-term "technical fix" for problems that are deeply rooted in social and political systems. For example, the world needs only a small amount of food to end hunger; thus, many people are now hungry because we choose, for many reasons, not to distribute the food equitably. RecDNA will not solve that problem. Critics contend that diabetes has many environmental and dietary causes about which we know very little.

In fact, the incidence of diabetes has a high correlation with income; poor people are victims in greater numbers than higher income people. Producing insulin in greater quantities and more cheaply will not stimulate research into the causes of diabetes.

The procedures that would be used to accomplish the projected gains also have potential technical problems. Many scientists have doubted whether recDNA techniques can be used to create a nitrogen-fixing plant. A similar question is raised about the actual production of insulin using recDNA procedures. Questions as to the safety of containment procedures are also posed. Enfeebled bacteria with recDNA could survive outside of laboratories, the vast majority of which would not be at the highest physical containment safety levels. A related concern is that even if escaped recDNA bacteria do die rapidly, there could still be a transfer of its recombined genetic material into E. coli that normally inhabits the human intestines. Would the local community and society then be endangered?

Critics have generally agreed that the likelihood of a serious accident is small, but have felt that the magnitude of such an accident would be great. There have been fears, as well, that as industry adopted recDNA procedures, the potential for a serious accident would increase because industry would ultimately produce recDNA products in extremely large batches and might permit less safe laboratory procedures in the quest for profit. Transportation of recombined bacteria also involves certain important risks.

Critics have also argued that since most of this research has been undertaken using federal funds, the public should have some control over that research. Informed consent should be provided by not only the community, but also by those who work in the labs and factories. Another serious concern is that life on earth has been evolving for billions of years and now humans have developed an ability to immediately and consciously overcome significant evolutionary trends and barriers. Should we be able to tamper with life and evolution itself? What wisdom have we to direct such powers?

These, then, are summaries of the two major schools of thought in the recDNA controversy of the early 1970s. Of course, differences of opinion and outlook existed within each group. For example, some who were anti-recDNA research minimized the containment issue to focus on the broader ethical and environmental impacts of the research.

When recDNA techniques were first being developed, little discussion of safety risks or potential dangers associated with the research occurred. The first serious public discussion of risk was a 15-minute segment of an annual conference of scientists in New England in June 1973. At this high-level research meeting the description of a recDNA experiment that would transfer a gene for penicillin resistance into E. coli raised safety-related concerns. In September 1973 the leaders of this conference wrote a public letter that called on the National Academy of Sciences (NAS) to establish a committee to examine safety questions related to recDNA research.

A committee of the leading figures in recDNA research from across the United States was created. The committee met at the Massachusetts Institute of Technology in April 1974 to respond to the safety concerns. The group called for an international conference to discuss the recDNA research question. In addition, the group took the unexpected and unprecedented step of calling for a voluntary international moratorium on "thoughtless" and risky recDNA experiments. This call reflected the scientific community's growing awareness of its responsibility to society for the products of scientific research. This emerging attitude grew, in part, from a sensitivity to questions of conscience addressed to scientists during the Vietnam War era. Specifically, the committee called for a halt to recDNA experiments that involved antibiotic resistance and the formation of dangerous toxins, experiments thought to have the greatest potential risk to society. The letter calling for this moratorium was published in the United States and Europe in June 1974 and the call for caution was in fact scrupulously observed until February 1975, when an international conference on recDNA was held in Asilomar, California.

Nearly 150 representatives from the United States and foreign countries attended the Asilomar Conference. The conference's specific topic was recDNA-related health hazards faced by scientists and the general public. An apparent assumption which many participants held was that some sort of regulations would eventually come out of the conference discussions. A leader, Sydney Brenner of England, helped set the tone in calling for regulations that would require future revision. He and many others felt that the emerging research controls should be strong enough so that any revision would be downward because they were initially too cautious rather than upward because of a still-hypothetical laboratory accident.

Many issues raised at Asilomar have remained important in the debates over recDNA. Short-term benefits of the research were weighed against long-term, uncertain risks. Legal concerns such as damage suits by lab workers were also broached, but did not occupy a major place in the conference discussions.

Eventually, the debate came down to two opposing camps. One, represented by James Watson who won a Nobel Prize for his role in discovering the structure of DNA, called for an end to the moratorium and a resumption of recDNA-related research. His position was that recDNA represented no greater danger than that faced in a cancer tumor research lab or hospital. He acknowledged that if a researcher were careless, he or she might be sued. However, he saw the threat of great danger to the public as minimal. The other camp advocated developing methods of biological containment that would use a special, enfeebled type of E. coli, labeled K-12, that would have great difficulty surviving outside the lab. They also called for varying levels of physical containment that would be provided by using safely designed and maintained laboratories.

Seeming to accept the notion that self-regulation would prevent burdensome outside regulation and perhaps a greater acceptance of regulation in both the scientific and lay communities, the steering committee made recommendations calling for mandatory use of physical and biological containment in recDNA experiments. The level of required containment would depend on how risky an experiment was thought to be. These recommendations were accepted nearly unanimously by the conference, including the Soviet delegation. The next task was to implement these still hotly-debated ideas.

The responsibility for turning the recommendations from Asilomar into practical guidelines fell to the National Institute of Health, the agency that oversees and funds a large share of medical research in the United States. The guidelines took on added importance because it was believed they would provide a pattern for other countries. Work by a number of conference participants selected by the NIH began the day after the conference and continued until the guidelines were officially released on June 23, 1976.

The initial NIH draft met stiff opposition because it was considered too lenient; a second draft was more stringent in following the Asilomar recommendations. However, new controversy arose in the comments of two eminent scientists, Erwin Chargaff of Columbia University and Robert Sinsheimer of Caltech. Cargaff saw the guidelines as addressing only laboratory hazards and not the broader ethical considerations of genetic manipulation. Sinsheimer questioned the evolutionary consequences of recDNA and the capacity of social-political institutions to handle the applications of this new technology. In addition, questions concerning the makeup of the NIH panel were raised by such groups as Science for the People and Friends of the Earth. As the committee's members were nearly all biologists, some of whom were already engaged in recDNA research, issues of bias were raised.

Public concern about the research spread across the country. Public hearings were held in Cambridge, Massachusetts; San Diego, California; Bloomington, Indiana; Ann Arbor, Michigan; and elsewhere. This local involvement and the fact that the NIH guidelines would not apply to industry ultimately prompted Congressional action. Much debate followed publication in June 1976 of the NIH guidelines calling for mandatory compliance by all institutions receiving federal research assistance and voluntary compliance in industrial or privately-funded laboratories. As universities prepared to conduct the research and comply with the guidelines, local involvement in the debate over recDNA research increased.

Handout 2b: DESIGNER GENES ACTIVITY TIMELINE

	Day 1	Day 2	Day 3-4	Day 5	Day 6	Day 7
Covington City Council	--Participate in introductory activities --Receive role assignments, form groups --Prepare for preliminary hearing	--Conduct preliminary hearing --Prepare and distribute press release --Receive handout 2g, begin research	--Conduct research in order to prepare questions on alternative courses of action --Prepare for running council meeting	--Compare research findings in class --Finalize preparation for running council meeting	--Conduct council meeting --Listen to presentations of other groups --Question other groups on cost/benefits of alternative courses of action --Reach decision	--Discuss how Covington will be affected by decision --Participate in class discussion and debrief
Regulation by Scientists Group Regulation by Lay Community Members Group Joint Regulation Group	↓	--Participate in preliminary hearing --Identify reasons for group's course of action --Begin research	--Research --Identify supporting evidence	--Compare research findings in class --Select spokesperson and three witnesses --Prepare presentations for meeting	--Make group presentations --Answer questions from other groups --Listen to other groups' presentations --Ask questions of other groups	↓

Handout 2c: INSTRUCTIONS TO GROUP LEADERS

YOUR PRIMARY TASKS ARE TO ASSEMBLE YOUR GROUP AND GUIDE THE GROUP IN PREPARING A LOGICAL ARGUMENT FOR ITS POSITION. HELP THE GROUP SELECT A SPOKESPERSON AND UP TO THREE WITNESSES WHO WILL BE CALLED ON TO SPEAK AT THE CITY COUNCIL MEETING. EACH GROUP MEMBER SHOULD OFFER AND EXPLAIN AT LEAST ONE REASON FOR THE GROUP'S POSITION. YOUR GROUP SHOULD TRY TO PROVIDE AS MUCH STRONG EVIDENCE AS POSSIBLE TO SUPPORT ITS POSITION. BE SURE EVERYONE HAS LOOKED CAREFULLY AT THE AVAILABLE DATA. YOU SHOULD ALSO CONSIDER ALL THE CONSEQUENCES OF THE VARIOUS ALTERNATIVES BEING DISCUSSED.

Handout 2d: RISK ASSESSMENT

> It is important to clearly understand the implications of the issue facing your group. One way of doing this is to assess the risks involved in research using recombinant DNA in Covington.
>
> Use the following questions and information from your role cards to make this risk assessment.

1. What potential negative effects may result from the research using recombinant DNA at Harrington University?
   a. Who will be likely to experience these effects?
   b. Where or how widely will these effects be experienced?
   c. How soon are these effects likely to be experienced?
   d. How easy will it be to reverse these effects? Why?

2. How great are these negative effects likely to be?
   a. How many people and what type are likely to be affected physically or psychologically?
   b. How great is the environmental damage likely to be?
   c. How costly are these effects likely to be?

3. What are the chances that these negative effects will actually occur?

Handout 2e: PRESS RELEASE

COVINGTON CITY COUNCIL CONSIDERS RISKS FROM recDNA RESEARCH

At a meeting yesterday the Covington City Council discussed the potential hazards of proposed recDNA research at Harrington University. Among the questions considered were:

--What are the likely negative effects?

--How great are these negative effects likely to be?

--What are the chances that these negative effects will actually occur?

Potential negative effects identified by various spokespeople at the hearing included. . .

There were speculations on the extent of these effects. Some of those discussed were. . .

Much of the discussion focused on the likelihood that these various effects would occur. General feelings included. . .

Handout 2f: DESIGNER GENES GROUP WORKSHEET

PART I: Participants

Name of Your Group's Spokesperson:

____

Name of Your Group's Witnesses:

____

____

____

Other Group Members:

____

____

____

____

PART II: A Recommended Course of Action

1. State clearly the course of action your group believes would be best to follow:

____

____

2. Based on the information presented in your roles, what are all the possible reasons for your position? For example, if your group advocates regulation by scientists only, its reasons may include:

--The research isn't very dangerous.

--The university promises to follow any federal guidelines.

--Other kinds of regulation would limit the freedom of scientific inquiry.

LIST YOUR GROUP'S REASONS IN THE SPACES ON THE LEFT-HAND SIDE OF THE CHART ON PAGE 2 OF THIS WORKSHEET. EACH GROUP MEMBER SHOULD IDENTIFY AT LEAST ONE REASON.

PART III: Research

Through library research, find information to support each reason you listed for question 2. For example, look at the first reason above--"the research isn't very dangerous." What evidence is available to support this reason? CITE YOUR REFERENCE ON THE RIGHT-HAND SIDE OF THE CHART ON PAGE 2.

	Reasons	Supporting Information
A.		
B.		
C.		
D.		
E.		
F.		

PART IV: Costs and Benefits

1. Outline briefly the costs and benefits of taking the course of action recommended by your group. This information will help you clearly state arguments for your position during the city council meeting. Cite references you have identified next to specific costs and benefits. An example is provided for you here.

Example: Reject the proposed expansion.

Costs	Benefits
--Potential restriction of the freedom of scientific inquiry	--Research done in Covington will be safer
--Potential loss of jobs	--No potentially dangerous "quick fix" cures to major problems
--Possible loss of quality science faculty at Harrington University	--Less risk of health problems to community
--Slower research on cures for many diseases	--Citizen control over scientific research and risks

Your Group's Alternative Course of Action: ______________________________

____

____

Cost	Reference	Benefit	Reference

Use a separate sheet of paper if necessary.

Handout 2g: COVINGTON CITY COUNCIL GROUP WORKSHEET

Your group is charged with making a decision on the regulation of recombinant DNA research within the city of Covington, specifically at Harrington University. You must decide what is to be done on this issue. How safe do you consider recDNA research to be? What form of regulation is to be established? Of course, many questions must be raised and answered.

PART I: Alternative Courses of Action

As a group, you should clarify the possible courses of action which may be taken in this case. List these alternative courses of action below (remember, each alternative for regulation should consider WHAT, HOW, and WHO):

1. ______________________________

____

2. ______________________________

____

3. ______________________________

____

4. ______________________________

____

5. ______________________________

____

PART II: Questions for the Public Hearing

During the city council meeting, you will want to ask questions of each group to help clarify their arguments. This will help you to make a good decision. Each role has several questions or concerns. These should be listed, along with other questions that come to mind, in the appropriate areas below. Some questions may be asked of more than one group. Finally, you will spend time researching answers to these questions and educating yourselves. You want to be knowledgeable decision makers. Place the references you find that you think answer the questions on the worksheet.

ALTERNATIVE 1: ____

____

	Question	Reference
A.		
B.		
C.		
D.		

ALTERNATIVE 2: ______

	Question	Reference
A.		
B.		
C.		
D.		

ALTERNATIVE 3: ______

	Question	Reference
A.		
B.		
C.		

D. ______________________________ ______________________________

______________________________ ______________________________

______________________________ ______________________________

PART III: Costs and Benefits

For each alternative presented during the meeting, outline the costs and benefits of taking that course of action. COMPLETE THIS SECTION DURING THE CITY COUNCIL MEETING. A partial example for one alternative course of action is provided for you. Be sure to add costs and benefits as they are mentioned by the groups and to ask for clarification where necessary. This will help you make your final decision.

Example: Regulation by lay citizens group.

Costs	Benefits
--Loss of freedom of scientific inquiry	--Safer research in Covington
--Potential loss of jobs	--No dangerous "quick fix" cures to major problems
--Possible loss of quality faculty at Harrington University	--Less risk of health problems in the community
--No quick cures for many diseases	--Citizen control over scientific research

Group 1, Proposed Course of Action: ______________________________

____

____

____

Cost	Reference	Benefit	Reference

Group 2, Proposed Course of Action:

Cost	Reference	Benefit	Reference

Group 3, Proposed Course of Action:

Cost	Reference	Benefit	Reference

Handout 2h: SUGGESTED RESOURCES ON DNA RESEARCH

Listed below are some library resources, journal articles, and contact organizations to get you started on compiling information for the upcoming Covington City Council meeting. NOTE: Some of your best information will come from recent newspaper and magazine articles, so be sure to check the Reader's Guide to Periodical Literature, Magazine Index, and any newspaper indexes available in your school or local library.

GENERAL LIBRARY RESOURCES

Annual Editions: Biology 84/85. Guilford, CT: Dushkin Publishing Group, 1984.

Facts on File. New York, NY: Facts on File, Inc., 1984.

Goulden, Paula. Medical Science and the Law. New York, NY: Facts on File, Inc., 1983.

Health. Boca Raton, FL: Social Issues Resources Series, Inc. (SIRS), 1985.

Levine, Carol, ed. Taking Sides: Clashing Views on Controversial Bio-Medical Issues. Guilford, CT: Dushkin Publishing Group, 1984.

Medicine 2000. New York, NY: Facts on File, Inc., 1985.

Technology. Boca Raton, FL: Social Issues Resources Series, Inc. (SIRS), 1985.

JOURNAL ARTICLES

Aharonowitz, Yair, and Gerald Cohen. "The Microbiological Production of Pharmaceuticals." Scientific American 245(September 1981):141-152.

American Biology Teacher 46(October 1984) and 46(November 1984). Two special issues on genetic engineering.

Geiger, Jon R. "Genetic Engineering--An Introduction to Two Special ABT Issues." American Biology Teacher 46(October 1984):365-372.

Rowe, Daryl E. "Biological Safety at the University of Georgia." Journal of Environmental Health 46(July-August 1983):13-18.

Vigue, Charles L., and William Stangiale. "Recombinant DNA: History of the Controversy." American Biology Teacher 41(November 1979): 480-83, 491.

Wright, Susan. "Setting Science Policy. The Case of Recombinant DNA." Environment 20(May 1978):6-15, 39.

JOURNALS DEALING WITH TOPICS OF BIOETHICS

BioScience

Journal of Environmental Health

Science

Scientific American

CONTACT ORGANIZATIONS

American Association for the Advancement of Science, 1333 H Street, NW, Washington, DC 20005.

Office of Recombinant DNA Activities. National Institute of Health, U.S. Department of Health and Human Services, Bethesda, MD 20205. (See "Guidelines for Research Involving Recombinant DNA Molecules," Federal Register, November 23, 1984.)

Handout 2i: HOW TO RUN A CITY COUNCIL MEETING

1. Announce the purpose of the meeting at the beginning.

2. Strictly enforce time limits on each group.

3. In order to maintain control:

   --Have all comments addressed to you.

   --Call on people who raise their hands.

   --Give each group equal time as much as possible.

   --Stress the need for participants to refer to specific sources of information when presenting arguments.

   --Question group members, but don't squabble with them.

   --Have all presenters initially state their names, places of residence, if possible, and professions.

4. Your agenda should be:

   a. Regulation-by-scientists group

      (1) Group leader

      (2) Maximum of three additional spokespeople

      (3) Questions to that group from council members

   b. Regulation-by-lay-citizens group (same as above).

   c. Joint-regulation group (same as above).

   d. General discussion and questions from council members.

   e. Concluding remarks (1 minute) from each group.

   f. City council confers, then announces decision.

   g. Discussion of reasons for chosen course of action.

Handout 2j: DESIGNER GENES DATA PACKET

This packet contains four pieces of data to help you prepare for the upcoming council meeting. These are: I, a proclamation from Covington concerning the proposed research; II, a list of useful terms; III, an explanation of security levels of physical containment in recDNA research; and IV, a chart depicting recDNA formation. Use the information in this packet as background to supplement your library research.

I. City of Covington, Massachusetts: Proclamation

WHEREAS:

Harrington University is seriously considering a program of experimentation in genetic recombinance and

WHEREAS:

Simply stated, this means that they will be creating new microorganisms that are nothing less than new forms of life, and

WHEREAS:

It is conceivable that these new life forms could create a serious threat to the public health if they got out of the lab area, lead to disease, and were not subject to known techniques of control, and

WHEREAS:

Some extremely capable biologists feel that this experimentation poses a more serious threat than the dangers from radiation, and

WHEREAS:

The building where the experiments will take place might be ant and roach infested, thus increasing the likelihood that these microorganisms might escape and lead to infestation, and

WHEREAS:

Covington residents would be the first to be affected if this danger materialized, therefore be it

ORDERED:

That the City Manager immediately and without delay call for a public hearing on this matter to be held within two weeks, and be it further

ORDERED:

That Harrington University officials, informed biologists, the Director of the Covington Hospital, and any interested citizens be invited so that this matter can be aired before the public.

II. Definitions and Terms of Genes and Chromosomes.

BACTERIA: One-celled microorganisms.

BIOHAZARD: The potential dangers to life, human and otherwise, which may result from a biological experiment.

CHROMOSOMES: Microscopic bodies which carry the genes.

DNA (**deoxyribonucleic acid**): Genetic thread-like structures found within chromosomes that control all living cells and which contain the genetic code.

E. coli (**Escherichia coli**): Common, normally harmless, bacteria found in the human intestine.

GENE: A segment of DNA which transmits hereditary characteristics.

MICROORGANISM: Any organism, such as bacteria, which can be seen only with the aid of a microscope.

P-1 (**minimal**): Standard laboratory procedures, no special precaution.

P-2 (**low**): No mouth pipetting (sucking up fluid into a tube), limited access to lab during experiments, precautions against release of airborne microorganisms.

P-3 (**moderate**): P-2 safety levels, plus control of atmosphere by use of negative air pressure, limited access at all times, biological safety cabinets for transferring materials, and solid waste packaged and sterilized before disposal.

P-4 (**high**): P-3 safety levels plus isolated laboratory, airlocks, construction of walls, floors, and ceiling with all penetrations sealed, shower rooms for clothing changes, and a special system and area for sterilizing wastes.

III. Levels of Physical Containment in Recombinant DNA Research.

P-1 Minimal Security

Standard lab construction
Normal handling procedures
No mouth pipetting
No eating or smoking
No food storage in lab
Unlimited public access

P-2 Low-Level Security

Standard lab construction
Access to an autoclave within building
Limited access to lab when experiments are conducted
Decontamination of wastes before disposal
No mouth pipetting
No eating or smoking
No food storage in lab
Insect and rodent control
Required use of lab coats or gowns

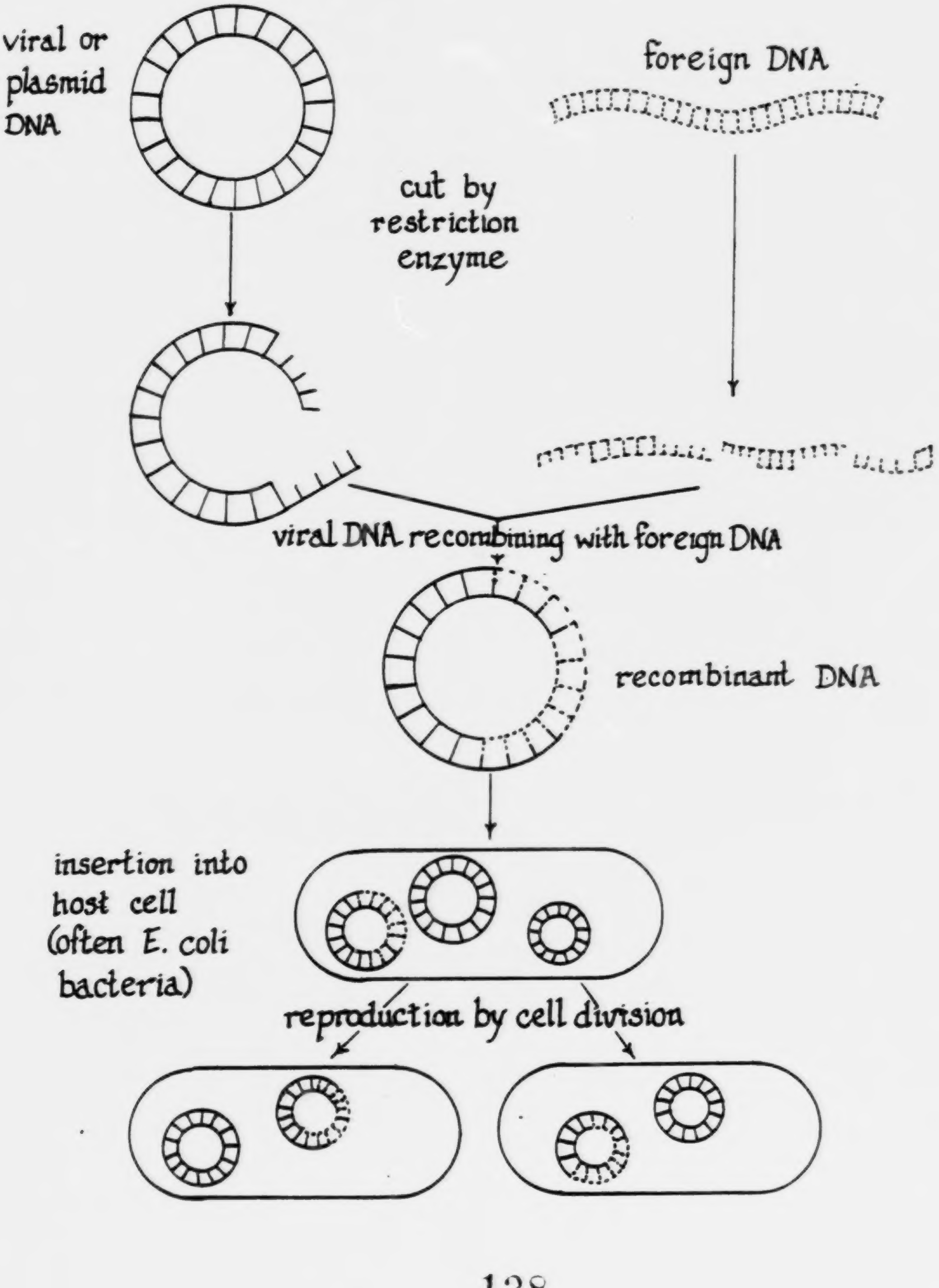
P-3 Moderate-Level Security

Controlled access to lab via airlock or double-doored facilities
Safety hoods in lab
Negative pressure ventilation with no recirculation of exhaust air
No work in open vessels--only in safety cabinets
Sterilization of all materials before disposal
No lab coats--only gowns allowed
Gloves must be worn during experiments

P-4 High-Level Security

Lab designed to contain microorganisms that are extremely hazardous and may cause serious epidemic disease
Facilities in a separate building or a part of a building that can be isolated
Strictly controlled access to building
Monolithic walls, floors, ceilings, with sealed air ducts, electrical conduits, etc.
Air-locks for entry of supplies and materials
Contiguous clothing-change and shower rooms for personnel entering and leaving room
Double door autoclaves for sterilization of any material before it leaves facility
Separate ventilation system with negative air flows and treatment system for air before being returned to atmosphere
All precautions required of a lower level of containment

IV. Recombinant DNA Chart


viral or plasmid DNA
foreign DNA
cut by restriction enzyme
viral DNA recombining with foreign DNA
recombinant DNA
insertion into host cell (often E. coli bacteria)
reproduction by cell division

A.J. CRESPIN

Having lived in Covington for most of your life, you care deeply about the community. Your successful insurance business has earned you the respect of both your profession and your community. Only in America could you be as successful as you now are. You believe that the freedoms that permit such success depend on America's being number one in the world. You wear the title "superpatriot" proudly.

You have followed the recombinant DNA (recDNA) story in the press and have strong feelings on the subject. You feel that science and scientists have helped make this country great. Science helped us win World War II, made us the breadbasket of the world, and gave us wonder drugs to cure illness. America has led the rest of the world in developing new technology, but present trends bother you. We seem to be falling behind Japan, West Germany, and the Soviet Union.

Thus, you believe recDNA work must be allowed to proceed without hindrance from the public or government bureaucracy. Delay in developing this technology could put us behind Russia. Might the Russians even use recDNA as a weapon? You feel scientists can best control and oversee this research to protect the public. After all, didn't the scientists voluntarily suspend the research when they were unsure of the risks?

You feel that scientists must be left to regulate this work for our nation's strength and good. Through such research as recDNA, America can again become the leader of world science and safeguard its position among other, perhaps hostile, nations.

MANFRED SCHLIVA

After getting a degree in microbiology, you began doing research at a large California university. There you helped develop the procedures that are now known as recombinant DNA (recDNA) techniques. Recently you and a colleague left the university and started a new corporation called Bio-tech. The company will use recDNA techniques to create such products as insulin, growth hormones, and products to help solve the energy crisis.

Your biggest goal at the moment is to develop a way, through recDNA techniques, to produce large quantities of inexpensive insulin for the treatment of diabetes. While the need for insulin is growing, the supply from present sources is dwindling. You believe recDNA is just the tool modern science has been looking for. It has already been used to cheaply synthesize a very expensive growth hormone called somatostatin. Any citizen involvement could hinder vital research that could improve many lives.

You see several reasons for giving scientists control over any regulatory process. Obviously, they know the most about what actually goes on in the laboratories and the risks of danger. They will be more rational when examining the costs and benefits of any research. Uneducated citizens just can't be expected to have the skills needed to do such evaluation.

You are also extremely excited about the possible industrial uses of recDNA techniques. There's money to be made, of course, but society will also gain greatly. If both your company and society can profit, that's great. Knowing this, you're afraid that citizens who know nothing about biology and recDNA will "cry wolf" and ruin all the good your company could possibly do. The fears expressed by opponents of the research are unreasonable and foolish. Any citizen involvement would create needless chaos and worry.

ANITA RAMIREZ

After a lot of hard work, you have reached a position of great respect in the field of microbiology. You feel you know a thing or two about both science and public policy. The recombinant DNA (recDNA) debate is giving you a headache because, in your mind, ignoramuses are meddling in "the craft of science." You have never told a lawyer how to defend a client, a carpenter how to build a house, or a plumber how to fix the toilet. You accept their judgments about the law, the rafters, and the plumbing because they are experts in their fields. Why, then, are common citizens trying to stick their uneducated noses into your field? These people wouldn't know a microorganism if it came up and shook hands.

Your feeling that any regulation should be left up to scientists is based on several factors. Scientists should be free to explore and develop the tool recDNA offers. The ultimate use of recDNA techniques and knowledge is a question society can answer later. Scientific research is neither good nor bad, and scientists don't decide on the use of their research. You are also aware of how much the government, or citizen advisory boards, can slow down, hinder, and frustrate scientific inquiry. Any citizen involvement tends to create more and more regulation. If we allow a little regulation, pretty soon all research will be stuck in the quicksand of public involvement.

Finally, you know that scientists are answerable to the public. Scientists have testified and will continue to testify before Congressional committees and public hearings. Scientists have nothing to hide; they merely want to do the work they were trained to do for the benefit of society.

WILLIAM WYATT

You are a scientist and professor of microbiology at Harrington University. As an early researcher in the field of recombinant DNA (recDNA), you know the history of this controversy pretty well and are surprised that it has gotten this far. That a city council is debating the pros and cons of such a complex research tool is disturbing, since the council members really are unaware of what they are debating. Your major gripe, however, is that the debate is redundant, since scientists have already debated this issue and found few things to be concerned about.

When the recDNA techniques were first showing both success and promise, scientists called a voluntary moratorium to the research. In an act of caution and restraint, the very scientists who were conducting the research said: "Wait a minute, let's address the risks involved in recDNA work." After some investigation, it was decided that certain experiments were safe and should be continued and that others were risky and should be halted. Regulation by scientists worked. These same scientists helped develop the National Institute of Health (NIH) guidelines for safe recDNA research. You agree with James Watson that these guidelines are, if anything, too stringent.

Finally, you know that recDNA is simply a tool for use in understanding how nature works. You and your colleagues are not building bombs, you're not designing a super race, and you're certainly not going to engage in any activity that might harm society. Scientists are responsible members of the community, well qualified to police their own work.

C.A. ZACHARIAN

As the 55-year-old vice-chancellor of Harrington University, you have seen many public protests. You believe that the controversy over recDNA research is a matter for scientists to debate. That this issue is entering the realm of public policy bothers you. You are very concerned about the potential regulation of university research and about the preservation of academic freedom.

You believe that scientists should have control over any regulation of recDNA work. There is little precedent for public involvement in the affairs of a private university. In fact, if the public wants control over what scientists do, why shouldn't they be allowed to help run the football team or the student dances? Your university gladly follows the National Institute of Health safety guidelines for recDNA. Thus, there is no cause for alarm, no cause for the public to attack your institution, and no need for them to oversee its research activities.

Once citizens get a taste of power, you fear they will want more control. How will you then be able to recruit fine faculty members? They will stay away because of research restrictions. With them will go the alumni funds that support the school. The community is flirting with disaster because any financial blow to the university will have a severe effect on the local economy. Any involvement of citizens will jeopardize a vital aspect of academic freedom and the economic future of the university and community.

J.D. GREEN

Your number-one complaint about present-day American society is that the government has decided to regulate nearly everything. Government regulation now is trying to sink its hooks into scientific research. Well, enough is too much!! Government regulation, or "citizen control" as they call it now, costs money and fouls everything up. Science should be left to scientists; after all, they helped build this country--without government regulation. Free, unhindered research gave us nylons and penicillin, weapons to keep us safe, and chemicals to preserve our food. Regulation of recDNA research should be left up to knowledgeable scientists.

What really bugs you is the idea that every time some new idea or scientific discovery is announced, the government butts in. What business does the city council have trying to tell scientists how to run their laboratories? Scientists claim that they can make cheap insulin, solve the problem of oil spills, and ultimately help solve the world food crisis. Aren't these terrific gains worth a little risk? Besides, scientists already are voluntarily following a set of safety regulations developed by the National Institute of Health.

You are concerned about Covington, to which you moved recently with your spouse. Scientists share this concern, however. After all, don't several live on your block? You therefore believe we should leave science to scientists, get out of the citizen regulation business, and get down to the task of keeping this country moving forward.

A.F. HASSAN

You are a 34-year-old member of the staff of the National Institute of Health (NIH), a government body concerned with health and safety-related concerns. You support regulation by the scientists involved in recombinant DNA (recDNA) research because you believe that local citizen groups should not be involved in scientific regulation. Any other regulation is the job of the federal government and organizations such as NIH. Thus, the Covington City Council should not vote to give itself, or citizens, any regulatory role.

NIH has a long history of involvement in the recDNA controversy. In fact, present safety guidelines were formulated by scientists and advisors working with your organization. These realistic and effective guidelines spell out specifically how and where experiments of varying risk must be performed. NIH is continuing in the area of recDNA regulation by revising and improving the guidelines. Thus, any involvement by Covington citizens would be redundant and probably counterproductive. The research is useful and should go forward.

As an NIH official, you have been working closely with Congress in drafting recDNA-related legislation. You believe that it is from Congress, not Covington, that any regulation should come.

ROBERT MANKE

As a 40-year-old design consultant for the firm of Safelab Inc., you have helped build many ultrasafe laboratories. In fact, designing high-security research labs is your area of expertise. Several years ago you designed the Lunar Receiving Laboratory for the first astronauts who walked on the moon. Your position is that scientists can best oversee and regulate recombinant DNA (recDNA) research.

You feel as you do because the National Institute of Health safety guidelines require specific types of laboratories for increasingly risky experiments. You build those labs, and you know they are safe when used by responsible scientists. If the public only understood clearly the various levels of physical (P-levels) and biological (Ek-levels) containment, much of the fear would subside. Overseeing of the research by the IBC--Institutional Biohazards Committee--also ensures safe procedures and laboratories.

Another reason you favor the continuation and growth of recDNA research under the control of scientists is that your company could stand to make a great deal of money. Since all research would have to be done in approved, safe labs, Safelab would get a lot of business. In our society, profit can't be ignored. For each new lab, jobs are created in the local community. Local plumbers, mechanical contractors, electricians, carpenters, painters, steamfitters, and general laborers all get in on the action. In addition, local people will be needed to help service the lab as maintenance people, bottle washers, and statisticians. Shouldn't this weigh heavily, especially in these rough economic times, as the Covington City Council decides this question?

DR. A. SALVATORE

You love science and scientific research. It's like the game "Clue" you played as a kid, in which the object was to figure out who did it, how, and where. Now you try to answer similar questions about DNA, the very basis of all life. After what seemed like a lifetime of schooling, you earned an advanced degree in microbiology and found a job at Harrington University. You are proud of yourself, and so are your spouse and two-year-old child.

On the question of control over recombinant DNA (recDNA) research, you advocate joint regulation by scientists and lay citizens for a couple of crucial reasons. First, any sound decision on recDNA policy must include scientific and technical data. Thus, scientists must have an active role in regulating recDNA research. This is all right, because scientists are not evil people out to poison and destroy the communities they live in. They are real people (like yourself!), with families and a desire to improve life. Sure, some are less than highly responsible, but that is true in all professions.

Secondly, scientific research is no longer believed to be a neutral process developing information for the good of society. Ever since the A-bomb, the public has been aware that scientific investigation can hurt as well as heal. Thus, the recDNA debate clearly must include the public as decision makers. Scientists must recognize the fears and concerns of local citizens and work with them to ease the worry.

You would, however, advocate that the regulatory panel be weighted 6-5 in favor of scientists. In the final analysis, this is a scientific question that needs to be resolved with scientific information. A majority of lay citizens could produce frustrating, unproductive stagnation due to lack of vital knowledge about recDNA questions and concerns. Your position is thus to involve the public but accept this as basically a scientific issue.

E.M. BUNA

You are a 29-year-old citizen of Covington. You are concerned, critical, and caring about your society and community, believing that citizens must be involved in public policy decision making. Since your college days, you have been actively involved in local political issues. You now have a few things to say about the debate over regulation of recombinant DNA (recDNA) research.

In keeping with your belief in democracy, you support joint regulation by scientists and lay community members. Scientists shouldn't have all of the power in a crucial question like this, but neither should lay citizens. Input on all sides of this issue will provide the basis for a decision that recognizes the interests of all involved. You disagree with many of the extravagant claims of the pro-recDNA people and with many of the outrageous fears of the anti-recDNA side.

Another reason for backing joint regulation is the apparent lack of communication between scientists and the public. Each group thinks the worst of the other. In reality, scientists and "the public" must live together; joint regulation might just be a first step toward a better relationship. This supports the notion that in a democracy, decisions must be made by all segments of society.

Your position is based on the assumption that the public can intelligently listen to scientific information and make sensible decisions. Lay citizens are not stupid. Given a responsibility like regulation of recDNA research, they will learn, ask questions, and make good judgments.

STANLEY WHITE

As a 47-year-old bottle washer and general maintenance man in the Harrington University laboratory, you've seen new research ideas come and go. You advocate joint regulation of recombinant DNA (recDNA) research by scientists and lay community members. You would favor a 6-5 majority of scientists on the panel.

Having watched scientists work every day for several years, you probably know more about them than do most of the Covington City Council members. You want the scientists to have majority control of the review panel for purely economic reasons. When push comes to shove, you feel those scientists will vote to continue the research, which means your job will be safe. Although you had trouble keeping jobs in the past, you have created a pretty nice life for your wife and three kids since starting this job a few years ago. You would like to avoid a situation that could risk your job.

Lay community involvement is also important to you. Since your first day at this job, you've wondered if some of the "stuff" you clean up from the labs could be dangerous. You certainly don't want your family and community endangered by recDNA research. Lay community members can act as watchdogs over the safety of the research. Because you've worked with scientists for so long, you know that many of them are absentminded and forgetful, even forgetting to turn lights off. Though never forgetful in a cruel manner, they do at times act carelessly while doing research. Community involvement could ensure safety and caution, while control by scientists would give you job security. Since the scientists are already committed to following the National Institute of Health guidelines, safety shouldn't be a big problem.

You would like to obtain a promise that lab workers and people like yourself would be trained in how to spot leaks or risks. Smarter workers are safer workers, and everyone is then better off.

A. HERRERA

You are a 41-year-old local lawyer who supports the sharing of responsibility for recombinant DNA (recDNA) regulation by a panel of five scientists and six lay community members. This particular makeup is important to you as a lawyer; the scientists who want to engage in this research should have the burden of convincing their fellow panel members that further research is safe and worthwhile. Although it goes against your legal training, you think recDNA research should be considered unsafe (guilty) until proven safe (innocent). The research should not now be fully banned, however.

A realistic, but cautious, attitude toward recDNA research is needed. You agree that the probability of an accident that would harm the public is very low. You also understand that the magnitude or impact of such an accident could be very high. As one author said, "This is research done by a few, understood by a few, which could affect millions." Scientists, therefore, need to explain the research to the representatives of those "millions." The public needs the power to protect its interests. Your panel would provide it.

A second concern is the question of "freedom of scientific inquiry." Your knowledge of the Constitution tells you that this freedom is not mentioned anywhere, not even in the First Amendment. Research is a privilege that is given to scientists to further knowledge and society, not an absolute freedom. Anyway, all freedoms have restrictions. Freedom of speech does not allow a citizen to shout "fire" in a crowded theater because that harms society. Research that could harm society, like recDNA research, can be limited if it endangers the community. The panel you favor would evaluate and judge those dangers.

Finally, your research into the regulation question has shown that several other cities have faced similar situations. Communities such as San Diego and Berkeley, California, and Cambridge, Massachusetts, have involved the public in recDNA regulation. Perhaps their solutions can provide help for Covington.

DR. KATHY BAUS

Upon becoming a medical doctor, you decided to work in the field of public health. For the past six years you have been the head of the Covington Public Health Department. At age 45, you have definite thoughts on scientific research, public health, and public policy. As chief local health officer, you feel your opinion should carry weight. You favor a panel for regulation of recombinant DNA (recDNA) research made up of five scientists and six local community members. This particular makeup is very important to you.

You feel that the research into recDNA should continue because of the potential good it could produce. If the research is to continue, scientists must be involved in the regulatory process. After all, they are experts in the field and can add a needed scientific and technical base to any discussion. However, the public must have ultimate say over any decision regarding recDNA activities in the Covington area. This is a local problem; federal regulations would be too alien and far away. You know Covington's needs better than any Washington bureaucrat.

Your first concern is the public's health. As a member of the community, you know that decisions affecting local health need public involvement. Joint regulation will provide that. Research will continue under the watchful eye of the public. In this way, the community can limit that which it fears and feel more comfortable with research that does continue.

As a public health official, you do have some concerns about recDNA. For example, scientists say recDNA will provide cheap insulin and help cure cancer. Rather than relying on recDNA for a "technical fix" of the problems of diabetes and cancer, you believe we need to alter our life-threatening habits by helping people eat right and eliminating environmental causes of cancer. Public involvement in regulation will help educate scientists to these important fact.

Finally, if recDNA research is to continue, you want assurance that adequate health monitoring systems will alert you to any accidents or risks. Careful, ongoing screening of workers for base-line health data is crucial in identifying possible future contamination. You also want information about the transportation of recDNA products through your community, the lab locations, and so forth. Only active public involvement in recDNA regulation can ensure that these requests will be met.

THE REV. JACK FITZPATRICK

As a religious leader in Covington, your concerns about recombinant DNA (recDNA) research are a bit more spiritual than those of others in the debate. You believe that both scientists and lay community members should share oversight responsibilities.

You're not so sure that recDNA is as neutral as some say, nor as devilish as others believe. There are, however, some real ethical concerns. Should scientists be "playing" with the very substance of life, tailoring it to their own whims and fancies? You know, as well, that scientific research created the atomic bomb, pesticides that poison our land, plastics that won't biodegrade, and chemicals that cause cancer. Yes, each of these developments has benefits , but the costs are real as well. Is recDNA another such two-sided coin?

In addition, this research is dangerous. Even though the National Institutes of Health guidelines state specific safety precautions and laboratory standards, organisms can be released. No matter how careful scientists are, they are still human and thus capable of making mistakes. How safe, really, can the research be? Can the good to be gained outweigh the risk?

You strongly believe that scientists and community members must discuss the research and concerns together. The goal of any regulatory body should be to debate the pros and cons of each new step in the research, keeping in mind all questions, including religious ones. Obviously, such a board would have to include both scientists and citizens.

R. ZNAMENACEK

You are 30 years old. You and your spouse have lived near the Harrington University labs for the past three years. Occasionally you smell strange odors and wonder if "stuff" they're working on in the lab could be harming you. Now the debate about recombinant DNA (recDNA) research makes you wonder if it might threaten your health. After all, you live close enough to the lab that any "bug" that got out would end up on your doorstep.

You support joint regulation with five scientists and six lay community members on the regulatory panel. You are realistic enough to know that wild horses couldn't stop research that so many scientists are excited about. For the safety of your future family and Covington, you want some public control over where and how the research will be conducted. Scientists can intimidate lay people with facts and statistics pretty easily, so you believe that the ultimate power (that extra vote) should be with the public.

You believe there are real risks in recDNA research at Harrington University because the building that will house the lab is infested with ants and cockroaches. If they can't get the ants out, how can they expect to keep recDNA organisms in?

DR. SHEILA BURKE

At 55, you have been a university official, National Institute of Health consultant, and research scientist (the position you now hold). You begrudgingly accept the fact that citizens are going to have some role in the regulation of recombinant DNA (recDNA) research. So, you want a panel made up of six scientists and five lay community members.

Citizens belong on the panel, but their presence does open up the possibility of "silly" regulation due to ignorance. How much can an uneducated nonscientist be expected to understand in debates on recDNA-related questions? A majority of knowledgeable scientists is vital if scientific progress is to continue. The potential of recDNA to greatly improve the quality of life for diabetics, starving people, and many others should not be blocked because of fears based on lack of knowledge. The panel that you support would ensure that this wouldn't happen.

As a former university official, you also recognize that a university must live with its surrounding community. Political reality forces you to accept some public involvement in this debate. You don't want to stir up anti-intellectual, anti-university feelings. You want the public to have a voice, but you think the scientists should have the final say.

PETER NIGHTINGALE

At 42, you are a respected biologist who teaches and does research at a large Eastern university. You have somewhat radical ideas about society, science, and your role as a scientific researcher. In the debate over recombinant DNA (recDNA) research regulation, you favor giving a lay citizen panel regulatory control. You are aware that most scientists disagree with you, but your feelings are strong and deeply rooted in what you believe to be right.

You believe that scientific research can never be considered neutral because someone--a politician or a general--is always looking to see how new information might be used. The development of the atomic bomb is only the most obvious of many examples. The techniques of recDNA will inevitably be used in some less-than-wholesome fashion, such as in human genetic engineering or chemical/biological warfare. Private industry will surely exploit the recombinant technique, putting profits before public need. In addition, the proposed containment procedures are not realistically going to prevent accidental contamination of the environment with products of recDNA research.

As a member of the socially active Science for the People group, you have taken the lead in bringing the question of recDNA regulation before the Covington City Council. You want much greater public involvement in the control of potentially dangerous research. Those in a community, or society as a whole, should be able to tell scientists whether they want the fruits of particular research. With proper understanding, citizens in Covington and other cities can tell scientists that they must follow much stricter research guidelines, ensuring the safety of the public if recDNA experiments are to continue. Regulations should cover the size of experiments, the number of experiments, and the containment of recDNA products.

Even with such guidelines and public education, citizens should have the ultimate decision-making authority over whether such research is to continue. Only then will they be safe from accidental infection, unknown diseases, and potential poisoning of the environment. In addition, only then will scientists start to direct their research toward more constructive ends that truly better the human condition. No longer, you hope, will scientists create dangerous drugs, pesticides, and other substances that could prove harmful to society. Scientists and the public will finally recognize their mutual and productive dependence.

P. HIGHWATER

As a Native American, you have always had a special feeling for the environment. This feeling led you into your present career as an environmental lobbyist for the Friends of the Land environmental organization. At 29, you are successful and involved. You foresee a good future protecting nature from the abuses of people. You favor regulation of recombinant DNA (recDNA) research by an active citizen panel. Distrustful of scientists and industry, you believe that responsible oversight will come about only through local control by citizens. Federal legislation is fine and necessary, but local citizens in the area where such research is being conducted must have control because they know their own community.

In the history of science and technology, the environment has always had to play "catch-up" in order to survive. We create chemicals like PCB, use then all over the nation (and world), and five or ten years later realize that they are causing cancer and killing people. Only then--when it is usually too late to do anything effective--do we ban the manufacture of the chemical and establish dumping procedures. Your concern is that the same thing not happen with recDNA. Citizens should guide the research, ensuring at each step that society is protected before any danger arises. An active citizen panel could achieve this goal.

You insist that environmental impact statements be filed by labs planning research with recDNA. You are in favor of public hearings and stricter guidelines than those established by the National Institute of Health. You feel that citizens can and should take active steps to protect the environment and the quality of life. While the benefits of recDNA research are still uncertain, it could potentially lead to outbreaks of harmful diseases and contamination of the environment by unknown new organisms. It must be carefully watched. As a matter of fact, you wonder if a temporary halt to recDNA research wouldn't be wise until all risks are assessed and safeguards established.

ANTHONY DOMINICKI

As the 47-year-old head of the local Oil, Chemical and Atomic Workers (OCAW) Union, you represent the people who would ultimately be working in plants and labs that use recombinant DNA (recDNA) procedures. Your position is that great prudence must be exercised in this area of new research. In fact, the research should be halted while risks are assessed. When it begins again, the research should be regulated by a citizen panel made up of workers and community members.

You have seen a long history of risks not being communicated to workers and the surrounding community. The voluntary guidelines being talked about are inherently weak, and the idea that containment of recDNA products will work is ridiculous. This has never worked; as a matter of fact, the Occupational Safety and Health Act (OSHA) was passed to protect workers from risks that always occur on the job, no matter what the guidelines say. The argument, you feel, is being stated inaccurately. Scientists keep saying "if something escapes"; your experience is that the phrase should be "when something escapes." If it can, it will, and recDNA on the loose probably would endanger lots of lives.

This really is an economic issue, not a scientific one. There is lots of money to be made, and you fear your workers' health will be sacrificed in the process. This has already happened in the chemical and atomic industries. In both cases workers were given assurances of safety, yet thousands are claiming that the atomic industry is related to cancer and that the vinyl chloride industry causes hundreds of deaths and health problems.

The fact that scientists disagree so strongly on the pros and cons and safety of recDNA demands caution. You would like to halt the research until scientists agree among themselves to protect society; if we then decide to continue it, the people who face the danger--workers and citizens--should control the regulation.

W.S. CHIN

Although you were born 41 years ago in China, you consider yourself thoroughly American after having lived here for more than 25 years. Your position on the recombinant DNA (recDNA) debate is that the research should be halted because it is unnecessary and potentially harmful. If it is to continue, citizens should control the regulatory process. Scientists like "toys" such as recDNA too much to leave control in their hands. Joint regulation would merely give a token voice to citizens who, realistically, are easily swayed by scientific lingo.

Scientists don't really need recDNA. It is merely a tool, not pure knowledge as is claimed. It is a shortcut way of producing new cells--really a nifty sewing machine able to stitch together pieces of DNA. The "freedom of scientific inquiry" issue is basically hogwash, since we can learn the same things, a bit more slowly, without recDNA. And recDNA has real risks, such as creating dangerous new organisms and incurable diseases. You feel that the general concept of "freedom of inquiry" must be balanced with the risks of such inquiry. Scientific freedom did, after all, make nuclear weapons and pesticides that poison lakes and streams. Is that worth it?

You also are anti-recDNA because it probably won't solve the problems its backers say it will. Take, for example, the claim that recDNA will end starvation by creating plants that fix their own nitrogen fertilizer in the soil. Your research indicates that this is extremely unrealistic and that we don't need much more food, just a decision to distribute what we have more equally. That's a political decision to be made whether or not we have recDNA. The same can be said about promises of better health care--new drugs aren't the answer. RecDNA is simply another "technical fix" promised to help solve social and political problems. It just doesn't work that way. We need to create a more equal society, not experiment with wild new methods like recDNA.

Probably the most important fact to recognize is that public funds pay for this research. Thus, the public should be able to determine how the money is spent and what safeguards will be enacted. Scientists must recognize that society can both reap benefits and face risks from the public funds supporting the research. Public control will make this a reality.

BRUCE SCOTLAND

Active for the past few years in the environmental movement and always concerned about social issues, you feel you must speak out on the recombinant DNA (recDNA) issue. You understand that this research will probably continue, so you want regulation by a citizen panel. Scientists are welcome to give opinions, testimony, and information, but decisions must be made by the local community members. The public is smart enough to make these decisions and to understand technical information.

Covington has been your home for 35 years, your entire life. You married several years ago, have a young daughter, and feel that this place is your home. Since it is your community and your environment, you want control over those things that may threaten you. After reading about chemical spills and pesticides in fish, you question how helpful science is. For the first time you might be able to exercise some control over what scientists do. You don't feel that scientists are bad or evil; it's just that they often don't seem to see the impact on the real world of something they create in a lab. Now you can help remove those blinders.

In addition, you are a bit tired of Harrington University "dumping" on Covington. It seems that whatever the university wants, it gets. The residents of Covington should tell the university that they, too, live in Covington and that their opinions count. A citizen regulatory panel for recDNA could assert that position.

Your final concern has to do with the industrial uses of recDNA. Several corporations already are using recDNA to produce goods and profits. Industry is not currently forced to follow any safety guidelines. Local communities--through a citizen panel--should be able to force industry to do so.

DR. D. E. NGUYEN

Recently, at age 33, you earned your doctorate (Ph.D.) in microbiology. During your schooling and experience as a research assistant, you realized that scientists often don't see the broad social and environmental impact of their research. This seems to be the case with recombinant DNA (recDNA) research. You believe that the work should continue, but under the watchful eyes of a committee made up of lay community members.

You are excited about the products that recDNA could produce--for example, insulin. However, you recognize that caution is needed, and you think that scientists really can't be trusted to exercise that caution. You recall Edward Teller, father of the A-bomb, commenting that since he knew he could build an A-bomb, he was obligated as a scientist to do so. Thus, any caution must come from a citizen review panel, not from the scientists or an Institutional Biohazards Committee (IBC), as spelled out in the National Institute of Health guidelines. Those guidelines are basically voluntary; they leave regulatory power with scientists in the university. These are the same scientists who want to build a recDNA laboratory at Harrington University in a firetrap with a horrible pest problem. How responsible is that?

Rather, citizens could listen to scientists and make wise decisions based on common sense and the public good. Maybe this is the first step toward making science more responsible to social concerns and needs.

FRIEDA SCHMITZ

You have been writing about science and the environment for ten years, beginning as a 26-year-old graduate student. You are now a reporter for the respected Environment and Society magazine. Your position is that citizens or lay community members should control regulation of recombinant DNA (recDNA) research. Cost would be slight and the Covington Public Health Department would be in charge.

Such a panel would ensure open investigation of the pros and cons of recDNA and protection of the public. Although some scientists do look out for the public good, others do not. A joint panel would make it too easy for scientists to overpower the citizens with technical information. A citizen panel with science advisors could hear testimony and then calmly and independently make a decision balancing the needs of scientists and the public.

In your investigations you have also discovered that it is generally microbiologists, the very scientists who want to continue recDNA research, who came up with the risk assessments. That's like trusting the fox's opinion of how safe the chickenhouse is! Citizen panels would insist on risk judgments by epidemiologists, local health officers, and plant workers. Such risk assessment is crucial if recDNA research is to be pursued safely.

MAYOR GUISEPPE VALARDI

Now in your second term, you are the 49-year-old mayor of Covington, Massachusetts. You played a large part in starting this controversy, and you have been active in getting the present temporary moratorium against recDNA research passed by the city council.

Your are strongly in favor of local control and you are generally anti-science. You feel that this is a political, not a scientific, question, and you want to show Harrington University that you are a political force that cannot be ignored. Your concerns include the following:

--Could some subhuman monster or dangerous "super-bug" be developed at the lab?

--Can citizens trust scientists to limit risks and hazards?

--Are the National Institutes of Health guidelines effective at both the university and industrial levels?

--Is the university going to keep forcing this kind of research on Covington?

--What arguments are there in favor of recDNA research?

DAVID STERN

Twelve years ago, at age 27, you moved to Covington to take a job as an urban planner. You have been a city council member for eight years. In your job, you have watched the community grow and Harrington University become more and more powerful. This concerns you. You don't see scientists as evil people, but some of the products of science have not been so good for society.

Your family lives near the proposed lab, so there is an added personal dimension to your decision.

Your major concerns are:

--How safe is the lab proposed at the university?

--What sort of health monitoring of workers and lab technicians is needed?

--Is scientific freedom of inquiry worth the possible risks or negative side effects?

--What are the actual hazards of this research?

TIM NOVAK

You are a 43-year-old general laborer for a construction firm in Covington. You like your job, your community, and your family. Having had only a high school education, you have more common sense than "book learning." This in no way makes you feel inferior or incapable of making good public policy decisions.

Recombinant DNA (recDNA) research sounds exciting, and it just might be the ticket to a healthier and better-fed world. On the other hand, nothing comes free in this world, and recDNA surely has some problems.

You feel you can make a good decision on regulation if these questions are answered:

--What containment methods are there to keep recDNA "bugs" in the lab and out of the Covington environment?

--Have other cities in the United States faced similar problems, and what have they done?

--If this research is not continued, will we be giving other countries in the world an edge over the United States in science?

--What are the benefits of recDNA research in the long and short run?

JUANITA CARLOS

You are a 37-year-old housewife, and you are extremely proud of your role. Raising your children has been rewarding, and serving on the PTA, the school board, and the city council has given you opportunities for growth as a person.

You are truly undecided about the issue of recombinant DNA (recDNA) research regulation. Answers to the following questions and concerns will help you make a decision--if not more easily, at least more logically:

--Can lay or nonscientist community members make reasonable, sound decisions on complex scientific matters?

--What moral and ethical questions are raised by recDNA research?

--Must our decision take into account regulation of private industry uses of recDNA as well as university research? What are the risks in each case?

--How have other communities in the United States tackled the problem of regulation?

R.J. POTROWSKI

You're a 38-year-old professor of history at Harrington University and a member of the Covington City Council. You believe that academic research--including recombinant DNA (recDNA) research--is a crucial activity that must be protected. You do, however, realize that you were elected by the entire community and that you must think about the interests of the public in addition to your own and those of the university.

Your concerns are these:

--Is this a matter to leave up to scientists, or should the public be involved?

--Are there other, safer methods that can achieve results similar to those of recDNA research?

--What are the feelings of the leaders of the university?

--Will regulation sacrifice academic freedom and hurt recruitment of new professors?

D.N. PIRNAK

A 52-year-old lawyer long active in Covington politics, you are excited about tackling the question of regulation of recombinant DNA (recDNA) research in your community. You think that some of these important issues should be debated in the city council, so that the public can make decisions potentially affecting their lives. After all, public money is used to do most of this research.

You are still up in the air on the regulation question. It bothers you that even scientists can't agree on whether recDNA is good or bad, safe or risky. You need answers to these questions in order to make a good decision:

--Is recDNA merely a "technical fix" for problems such as diabetes and the world food crisis, which have deeper causes? Is recDNA like a bandage that covers a wound but could ultimately cause problems, too?

--How does the local health department feel about recDNA?

--Do we need controls now, early in the research, before research and production get out of hand?

ROBERT THORNSTEIN

At age 32, you are a successful plumbing supply contractor and a Covington City Council member. To be honest, you don't really want to tackle the problem of recombinant DNA (recDNA) regulation. You wonder how such a confusing technical issue ended up in front of you. Nonetheless, you and your wife have put together a series of questions to help you in your decision-making process. The answers to these questions will provide some basis for reacting to the questions about recDNA regulation.

--Might recDNA someday become a profitable business venture that could help the economy of Covington? What would be the economic benefits if research is continued and the losses if regulation is imposed?

--Are there actual or only hypothetical risks in recDNA research?

--What is the most economical, yet safe, form of regulation?

--Should the city council be debating this issue?

ACTIVITY 3
RAINY DAY BLUES: THE ACID RAIN CONTROVERSY

OVERVIEW:

The simulation, "Rainy Day Blues," involves the continuing controversy over control of acid precipitation or acid rain. This case is based on the actual controversy over where a coal-fired power plant would be built in Atikokan, Ontario, a small town just north of Minnesota's Boundary Waters Canoe Area (BWCA). For this simulation, a fictional International Regulatory Commission (IRC) made up of United States and Canadian citizens was created as the decision-making body.

Students take the role of IRC members, Canadian and United States residents holding various views regarding the risks associated with acid rain, and other interested individuals. The students participate in a simulated IRC hearing to argue whether, given the potential impacts of acid rain, the proposed power plant should be built. Three basic alternatives, are considered:

--Building the power plant at Atikokan as originally proposed and designed.

--Denying the request to build the proposed power plant.

--Building the plant but modifying the original design with the addition of pollution control devices known as "scrubbers." This plan also includes air quality monitoring as a preliminary to adding the scrubbers.

Students are divided into groups representing each of the three positions on this issue and a decision-making group, the previously mentioned International Regulation Commission. In a library and community research component, students locate information to support their group's position. To facilitate the research component of the activity, all data collected is compiled into a classroom library and shared by all students.

The culminating exercise for this activity is an IRC hearing, during which the three citizens groups present their positions, supported by data they have collected, to the IRC members. Through analysis and questioning, the IRC must reach a majority decision on the issue and announce this to all groups. A discussion analyzing the different viewpoints and the decision-making and risk-management processes concludes the activity.

OBJECTIVES:

After participating in "Rainy Day Blues," students will be better able to:

1. Explain and discuss the social, political, and economic factors that influence decisions made on public policy issues of science

and technology (for example, short- and long-term employment, energy policies, environmental damage, and international cooperation).

2. Identify and describe the central conflict involved in a problem requiring social action and decision making.

3. Clearly state the interests and values involved in a problem situation.

4. Systematically analyze the risks in a problem situation and consider ways to minimize those risks.

5. Identify and state alternative solutions to a problem situation.

6. Identify and analyze the probable consequences of particular courses of action.

GRADE LEVEL: 9-12

TIME: Approximately 7 class periods. The "Activity Timeline," Handout 3b, provides a schedule of activities.

MATERIALS: 30 role cards

Handouts. Reproduce as indicated.

3a: Background Notes: Acid Rain and The Atikokan Power Plant Controversy (1 per class member)
3b: Acid Rain Activity Timeline (1 per group)
3c: Instructions to Group Leaders (1 per group)
3d: Risk Assessment (1 per group)
3e: Press Release Form (1 for IRC group)
3f: Rainy Day Blues Group Worksheet (1 per advocacy group)
3g: International Regulatory Commission Group Worksheet (1 for IRC group)
3h: Suggested Resources on Acid Rain (1 per class member)
3i: How to Run an International Regulatory Commission Hearing (1 per member of commissioner's group)
3j: Acid Rain Data Packet (1 per group)

PROCEDURE:

Before beginning this activity, the class should read the background information on the controversy over acid rain and the construction of a coal-fired power plant at Atikokan, Ontario, included in Handout 3a, "Background Notes." This information will be critical in providing you and the students the background needed to participate fully in the activity. Notes may be reproduced and distributed to students as homework reading before beginning the simulation.

The day before the simulation is to begin, teachers may introduce some general issues surrounding controversies over scientific research. Conduct a very brief discussion of the following questions:

--Is progress always "good" or "bad"? Is it neutral? Explain your answers.

--Should any kinds of potential environmental damage be just cause to stop a potentially beneficial construction project? Give examples.

--Can, or should, citizens have an active voice in such scientific debates as those surrounding acid rain? Why or why not?

Day 1: Introduction

A. Use the information in the "Background Notes" to introduce the general issue of acid rain. Charts in Handout 3j, "Acid Rain Data Packet" may be used to briefly explain what acid rain is and how it is formed. Ask students to speculate on potential harmful effects of acid rain.

B. Highlight the specifics of the role-play situation. Students should also be introduced to the decision-making steps outlined in the "Conceptual Basis for CREST" (pp. 3-7).

C. Assign and distribute role cards to each student and divide the class into the following four groups.* Allow 10-15 minutes for students to read their cards and introduce themselves to their groups.

Don't Build the Power Plant

Jake Deerstalker
B. C. Swensen
Larry Gorst
Anita Ruiz
J. O. Chinsolm
Rudy Gilboy
P. B. Gaston
Alicia Johnson

Build the Power Plant with Modifications

R. A. Kowolski
Jacques Reynold
Libby Johansson
A. L. Mukdananda
John Tipple
Sharon Hoge
S. Zorab
T. Polachek

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*Names with initials may be played by males or females. If the class has fewer than 30 students, the same relative size should be maintained for each group. The unused roles should be added to the data compiled for that group since the information in them is important for the group to consider. In larger classes, students can work in pairs on single roles.

Build the Power Plant	International Regulatory Commission
Robin Michelson	Pierre Broussard
J. McHenry	C. Codianno
Mary Vellum	A. Griffith
Tom Krieger	R. Zolot
K. Sprenger	Harriet Johnstar
Susie Loeb	Hon. P. Cornwall
P. Schmidt	M. Hernandez

D. Give each group a copy of Handout 3b, "Activity Timeline," and quickly review its contents. Identify one or two leaders for each group. They will be responsible for ensuring that their group attends to its tasks. Each group leader should receive a copy of Handout 3c, "Instructions to Group Leaders."

E. The initial task for the three advocacy groups is to begin to assess the risks related to acid rain and the use of coal to generate electricity. Students should use information from the group members' role cards. Each group leader uses Handout 3d, "Risk Assessment," to guide discussion in his/her group.

F. The IRC group prepares to conduct a preliminary meeting focusing on the "Risk Assessment" questions. This meeting will help clarify the potential negative effects of the proposed power plant. This process also represents the first of the decision-making steps--identifying and clarifying the central problem.

G. (Optional) As homework, students should become completely comfortable with the information in their role cards. Teachers might assign students a re-reading of the "Background Notes" from the perspective of their role card assignments.

Day 2: Preliminary Hearing and Intragroup Discussions

A. Gather the class for a 5-minute review of the information they compiled on Handout 3d, "Risk Assessment."

B. Using the "Risk Assessment" handout as a guide, the IRC group conducts a brief (approximately 15-minute) preliminary meeting focused on the following questions:

--What are the potential negative effects of coal-generated electricity and acid rain?

--How extensive will these effects be?

--How likely is it that these effects will occur?

--National self-interest: Canada cannot allow the United States to dictate its energy and environmental policies.

Don't Build the Power Plant

--The proposed power plant is a threat to the environment. Major parks in the area are particularly susceptible to the impacts of acid precipitation.

--Should acid rain prove to be a serious problem, the local resort economy would be severely damaged. The absence of fish in many upstate New York lakes can be pointed out.

--Questionable need for the Atikokan plant.

Build the Power Plant with Modifications

--This group admits that acid rain is, or could prove to be, a serious problem, but it recognizes that the energy crisis is real and people are unlikely to seriously practice conservation.

--Build the plant with precautions against acid rain damage to parks.

--An extensive air quality monitoring system with the provision for the addition of scrubbers is one compromise.

--Fifty or ninty percent effective scrubbers built onto the plant when it is constructed is a more costly alternative.

--This is an excellent opportunity for Canada and the United States to cooperate on an international problem.

Day 3-4: Research: Preparation for the International Regulatory Commission Hearing

NOTE: A major component of this activity is to involve the students in research on the topic of acid rain. In this phase, each group of students will be responsible for locating information from a variety of sources to support the group's position on the "Rainy Day Blues" issue. Each group will collect at least six pieces of information which they will use to support their arguments. They will share these materials with the rest of the class through a classroom resource center on Day 5.

Ideally, the teacher will be able to photocopy these materials for inclusion in the resource center. If this is not possible, students should check out materials for classroom use.

A list of suggested resources is provided in Handout 3h. Not all of these resources may be available to all schools and communities. Students should be encouraged to consult the local library as well as

Remind IRC members that at this point everyone is operating with very little data. There will be some disagreement about the potential risks, especially the magnitude and the probability of their occurrence. In trying to assess the potential risks, the IRC might focus on the worst that could happen and identify the various positions on how likely it is that it will happen. Discussion should be kept to a minimum. More extensive discussion of the risks will take place on Day 6, the IRC hearing.

C. Following the preliminary meeting, the IRC prepares a news release using Handout 3e, "International Regulatory Commission Considers Risks from Acid Precipitation." This news release should then be reproduced and distributed to the other groups.

After completing the news release, the International Regulatory Commission begins to consider the alternative courses of action provided on Handout 3g, "International Regulatory Commission Group Worksheet." The group should identify important questions related to each alternative for use in guiding the discussion during the IRC hearing to come.

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While the IRC group is preparing the news release, other groups work on Parts I and II of Handout 3f, "Rainy Day Blues Group Worksheet," in preparation for making presentations on their positions during the IRC meeting. Each advocacy group should identify its proposed course of action and discuss reasons for its position. The reasons should be listed in the left-hand column of the worksheet. Group leaders should see that each group member identifies at least one reason for that group's position. Careful reading of the role cards will facilitate this process.

The following are some of the key arguments that can be made by each of the three groups in "Rainy Day Blues." Many of these arguments can be identified through careful reading of "Background Notes" and the role cards. During research on Days 3 and 4, groups will seek specific supporting data for the arguments they choose.

Build the Power Plant as Proposed

--Periodic "gluts" notwithstanding, there is a finite amount of increasingly expensive oil. Because coal is abundant in North America, increasing its use as a fuel for generating electricity is logical.

--The Atikokan plant will help supply needed energy.

--While acid rain is a problem elsewhere it has not been proven that it is an immediate and pressing problem in this instance at Atikokan.

--The plant will supply jobs and thus help the area's economy.

--Statistics prove that the bulk of acid-rain-causing pollution flows from the United States into Canada not vice versa.

C. The IRC group will spend the last half of class studying Handout 3i, "How to Run an IRC Hearing." This group should also review all evidence in the resource center in order to be able to respond to all groups during the hearing. At the end of Day 5, each of the four groups should be fully prepared for the IRC hearing.

Day 6: International Regulatory Commission Hearing

A. Before the IRC conducts the open meeting, outline meeting procedure on the blackboard as follows.

The group advocating building the power plant as proposed should make its presentation first. The spokesperson should briefly present the major arguments; up to three witnesses may present additional points. All presenters should refer to and show specific resources when supporting their arguments. Following each presentation, the IRC should take several minutes to question the group to clarify its position. This pattern should be repeated for the build-the-power-plant-with-modification and the don't-build-the-power-plant groups. After all three presentations have been made, an open question-and-answer session should be held, followed with discussion by the IRC.

B. Using Handout 3i, "How to Run an IRC Hearing," the IRC conducts the meeting. During the hearing, the IRC members should use the questions they identified on their worksheet to guide discussion. They should also ask each group for information on the costs and benefits of their proposed course of action. Part III of the "International Regulatory Commission Group Worksheet" will be useful for this purpose.

C. When the discussion is completed, allow each group 2 minutes to plan a 1-minute final statement. Each group spokesperson presents the statement to the hearing in the same order as the original arguments.

D. At the completion of presentations and questions, the IRC meets for 5 minutes to select a recommendation and then announces its decision to the class.

Day 7: Final Discussion (Debriefing)

**This phase is crucial in helping students recognize what steps they have followed in the risk-management/decision-making process.

A. Each group should spend 5-10 minutes discussing how the IRC's decision will affect the group members and their community.

B. The teacher should then hold a brief discussion to identify ways the decision will affect different individuals.

the school library, to contact local organizations and to look for information on this topic relevant to their own state or region. If students have not already received a copy of Handout 3j, "Acid Rain Data Pack," distribute one to each group. Materials in this packet may supplement but should not substitute for student research.

A. The IRC will conduct research necessary to complete Part II of Handout 3g, "International Regulatory Commission Group Worksheet." Members must identify important questions for each alternative course of action, locate information related to these questions, and record their references on the worksheet. This process will help them prepare for the IRC hearing. In order to question each of the groups after their presentations at the hearing, IRC members must have a clear understanding of the pros and cons of the issue. During this time, IRC members should also study Handout 3i, "How to Run an International Regulatory Commission Hearing".

B. The other three groups conduct similar research in order to complete their "Rainy Day Blues Group Worksheets" in preparation for the IRC hearing. Through library research, each group member must find at least one piece of information to support the position outlined by the group in section II of the worksheet.

Teachers should emphasize to all groups that the quality of each group's presentation, and ultimately its influence on the final decision, will depend on how well group members research the issue, how carefully they select relevant data, and how clearly they communicate this information during the IRC hearing.

Day 5: Research Sharing

A. On Day 5 data compiled from the four groups is made available to all class members through a classroom library. Tables at the back of the room or file folders can serve as the resource center. During the first half of class students should look carefully at the information which will be used by the other groups and make notes of additional facts and arguments that they may have to refute. The IRC group AND THE TEACHER should be very careful to become familiar with all the evidence compiled.

B. During the last half of class, each of the three advocacy groups goes through its group worksheet and prepares arguments for the IRC hearing, to take place on Day 6. Each group will discuss how its presentation will be made to the IRC. They will each pick a spokesperson and three witnesses to present at the hearing.

Teachers should clarify group members' roles. The spokesperson for each group will prepare to present the main arguments and supporting information, while each witness must add some new perspective and information. Each participant should collect the resources he/she will display as evidence the next day. Remaining group members will act as prompters during the hearing and thus should be confident of all evidence and procedure.

E. Finally, turn the students' attention to the decision-making process. Have them review the six decision-making steps followed in this activity. Then, use the framework below to review the process they followed in the case. As they answer the questions, you should fill in the framework on the chalkboard. This page may also be reproduced and assigned as homework at the end of Day 6.

C. Next, the teacher should have the class turn its attention to some of the key issues in the case. The following questions can be used to help guide the discussion:

--Which spokespeople were most convincing? Did you accept the testimony of government officials, company spokespeople, scientists, and regular citizens equally? Explain.

--What, in the final analysis, are the major benefits and disadvantages of building a coal-fired power plant at Atikokan, Ontario?

--Does acid rain concern you or cause you to worry?

--Do you feel that a decision such as this one should be made as it was in our class? Should citizens have a strong voice in such policy issues?

--What data were most persuasive in this case? Explain. What data were least convincing?

--What are the value differences between such spokespeople as an environmentalist, sports fisher, Ontario Hydro executive, and EPA scientist? To whom do you best relate? Explain.

--Can technology such as scrubbers ultimately solve all of the problems facing our society?

D. Finally, the class should consider carefully the decision-making and risk-management processes, using the following questions:

--Did all groups recognize the same risks? Why or why not?

--Were there any risks on which everyone agreed? What evidence was used to identify these risks?

--Which risks were seen as most serious? Why? Which were seen as least serious? Why?

--Who faced the risks (for example, residents, local businesses)? Did they voluntarily face these risks?

--Do you think it is fair for businesses or government to create risks for people without their knowledge or approval? Why or why not?

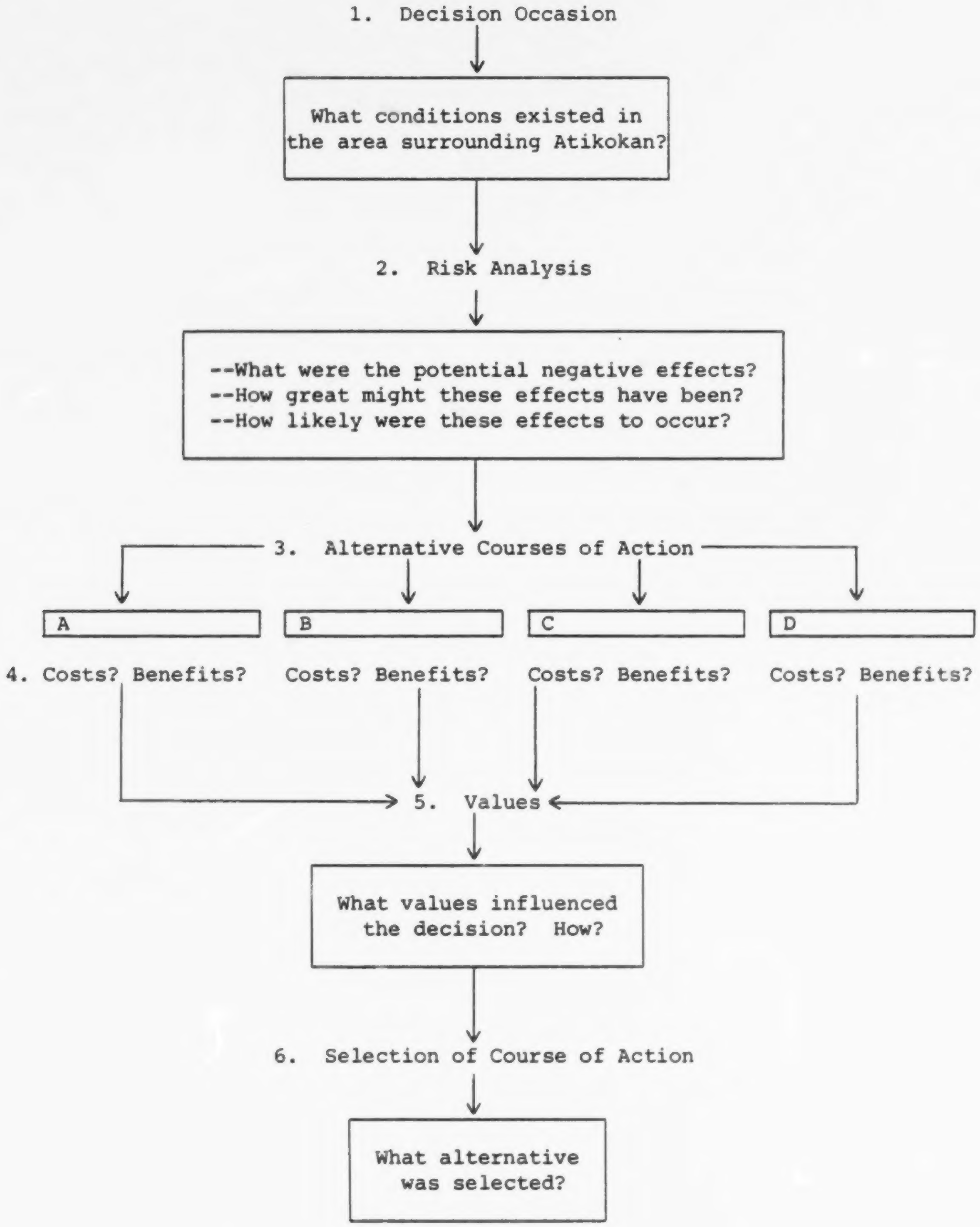
--What values influenced the positions held by the different groups? How did these values affect the conflict over the Atikokan power plant case?

--What role did technology play in the acid rain conflict? Did it help create the problem? Add to it? Help resolve it? Explain your answer.

Ask the students to match the six decision-making steps with the six parts of the framework above. The following is a brief description of how they should match up.

Decision Making	Risk Management Framework
Defining the Issue	1. Decision Occasion 2. Risk Analysis
Recognizing Interests and Values	5. Values
Identifying Alternatives	3. Alternative Courses of Action
Locating and Using Information	All
Probable Consequences	4. Costs and Benefits
Selecting Course of Action	6. Selection of Course of Action

D. As a closure activity, go around the room asking each student to indicate how he or she would now vote if faced with a public referendum on an issue related to acid rain.


1. Decision Occasion
What conditions existed in the area surrounding Atikokan?
2. Risk Analysis
--What were the potential negative effects?
--How great might these effects have been?
--How likely were these effects to occur?
3. Alternative Courses of Action
A
B
C
D
4. Costs? Benefits?
Costs? Benefits?
Costs? Benefits?
Costs? Benefits?
5. Values
What values influenced the decision? How?
6. Selection of Course of Action
What alternative was selected?

Handout 3a: BACKGROUND NOTES: ACID RAIN AND THE ATIKOKAN POWER PLANT CONTROVERSY*

This background guide for "Rainy Day Blues" will help you understand the major issues related to acid rain and the specifics concerning the Atikokan controversy. This information and a quick reading of the data packet should enable you to discuss acid rain with your students. As a precautionary note, all of the "answers" on the science of acid rain are not in. Legitimate controversy exists about its causes, effects, and impacts.

Acid Rain

Combustion of tremendous quantities of fossil fuels such as coal and oil results in discharge of approximately 50 million metric tons of sulfur and nitrogen oxides into the atmosphere of the United States annually. Through a series of complex chemical reactions, these pollutants can be converted into acids, which may return to earth as components of either rain or snow. This acid precipitation, more commonly known as acid rain, may have severe ecological impacts on widespread areas.

Hundreds of lakes in North America and Scandinavia have become so acidic that they can no longer support fish life. More than 90 lakes in the Adirondack mountains in New York state are fishless because acidic conditions have inhibited reproduction. Recent data indicate that other areas of the United States, such as northern Minnesota and Wisconsin, may be vulnerable to similar adverse impacts.

While the effects of acid precipitation on lakes have been well documented, data related to possible soil and plant impacts are just beginning to be developed. Preliminary research indicates that agricultural yields can decline as a result of both the direct effects of acids on foliage and the indirect effects resulting from the leaching of minerals from the soil. The productivity of forests may be similarly affected.

Acid deposition is also contributing to the destruction of stone monuments and statuary throughout the world. The 2500-year-old Parthenon and other classical buildings on the Acropolis in Athens, Greece, have decayed much more rapidly in this century as a result of the city's high air pollution levels. Research is underway to clarify the role of acid rain in this destruction.

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*Based on "Acid Rain Research Summary." Washington, DC: United States Environmental Protection Agency, 1979. #EPA-600/8-89-028; and Glass, Gary E., and Orie L. Louchs, "Impact of Airborne Pollutants on Wilderness Areas Along the Minnesota-Ontario Border." Duluth, MN: U.S. Environmental Protection Agency Laboratory.

Recognizing the potential seriousness of the acid rain problem, President Carter's Second Environmental Message to Congress in August 1979 called for a minimum $10-million-per-year research program to be conducted over the next ten years. The Environmental Protection Agency and the Department of Agriculture co-chair the Acid Rain Coordination Committee established to plan and coordinate the federal interagency program which is presently being developed.

In 1977, sulfur oxides accounted for 14 percent (27.4 million metric tons) of the total air pollution in the United States, while nitrogen oxides accounted for 12 percent (23 million metric tons). Although other pollutants also act as precursors to acid rain, these two oxides are believed to be the major contributors.

Sulfur oxides (SO_x) are primarily emitted from stationary sources such as utility and industrial boilers burning coal as a fuel. Nitrogen oxides (NO_x), on the other hand, are emitted from both stationary and transportation-related sources such as cars and trucks. Approximately 56 percent of the NO_x discharged into the atmosphere in 1977 resulted from the combustion of fossil fuels by stationary sources, while 40 percent originated from transportation-related sources. Over the next 20 years the combustion of fossil fuels is expected to increase significantly. In particular, emissions of nitrogen oxides from stationary sources are likely to increase rapidly during this period.

The most common sulfur and nitrogen oxides are sulfur dioxide (SO_2) and nitric oxide (NO). After being discharged into the atmosphere, these pollutants can be chemically converted into sulfuric (H_2SO_4) and nitric (HNO_3) acid through a process known as oxidation. Oxidation can occur by several complicated pathways or mechanisms. Other acids also contribute to the acid rain problem. Hydrochloric acid (HCl), for example, may be emitted directly from coal-fired power plants; it is frequently found relatively short distances downwind from the source.

The process by which acids are deposited through rain or snow is frequently called wet deposition. An atmospheric process known as dry deposition may also occur. Dry deposition is the process by which particles such as fly ash, or gases such as sulfur dioxide (SO_2) or nitric oxide (NO), are deposited on, or absorbed into, surfaces. While these particles or gases are normally not in the acidic state prior to deposition, it is believed that they are converted into acids after contacting water in the form of rain, dew, fog, or mist following deposition. The precise mechanisms by which dry deposition takes place, and its effects on soils, forests, crops, and buildings, are not adequately understood. Much research will be undertaken in the coming years to clarify its contribution to the overall acid deposition problem.

Various sulfur compounds which may act as precursors to sulfuric acid are known to travel as far as several hundred kilometers per day while in the atmosphere. During transport these pollutants may easily cross geographical and political boundaries. This situation creates numerous national and international regulatory problems since air pollution standards of one state or country can have an indirect or direct impact on the natural resources of another. Research is underway to clarify the transport processes associated with the major pollutants contributing to the acid deposition problem.

The pH, a numerical value used to describe the strength of an acid, is determined by a mathematical formula based on a solution's concentration of hydrogen ions (H^+). The pH scale ranges from 0 to 14. A value of pH 1 is very acid (battery acid), pH 7 is neutral, and pH 13 is very alkaline (lye). Because of the logarithmic nature of the scale, pH 4 is 10 times more acidic than pH 5, 100 times more acidic than pH 6, and so on. Precipitation is defined as being acidic if the pH is less than 5.6--the pH of normal, unpolluted rain. The slight natural acidity of normal rain is due to the presence of carbonic acid (H_2CO_3), which is formed by the reaction of atmospheric carbon dioxide (CO_2) with water.

As was pointed out earlier, fish populations are especially sensitive to changes in the pH of their surroundings. A recent study of several hundred Norwegian lakes showed that of the lakes having a pH between 5.5 and 6.0, fewer than 10 percent contained no fish. At pHs of less than 4.5, more than 70 percent of the lakes were fishless. Acidic lake water also affects fish indirectly. Low pH water frequently promotes the release of potentially toxic metals from the lake beds. Aluminum and mercury, for example, are frequently found in high concentrations in fishless lakes. These metals are released from soils at approximately pH 4.5 so rainfall runoff may carry aluminum from nearby soils into lakes or streams, thus magnifying the problem.

The average annual rainfall pH is presently less than 4.5 in most of the eastern United States. Lakes that lack a buffering capacity, or ability to chemically neutralize this acidity, face serious ecological harm.

The environmental effects of acid deposition, both wet and dry, are diverse and widespread and are being documented by research throughout the world--especially in Scandinavia and the eastern United States. Some of the reported effects are:

--Acidification of lakes, rivers, and groundwaters, resulting in damage to fish and other components of aquatic ecosystems.

--Acidification and release of metals from soils.

--Possible reductions in forest productivity.

--Possible damage to agricultural crops.

--Deterioration of man-made materials such as buildings, statuary, metal structures, and paint.

--Possible contamination of drinking water supplies by metals being released from soils and pipelines.

The problem of acid precipitation in the United States has only recently come under public scrutiny. The Clean Air Act of 1970 led to mandatory control of various forms of pollution produced by industrial furnaces. Measurements for the enforcement of the Act were to be taken locally. The result was a phenomenal proliferation of extremely tall smokestacks, up to 1200 feet high, that would send the pollutants downwind and away from the local area. Air quality indexes did improve in many areas, but a trade-off was created. The long-range transport of the pollutants, as discussed above, led to the formation of acidic precipitation. At present, New England states are suing Ohio power companies for causing acid precipitation.

A second reason for constructing tall smokestacks was the notion that the pollutants, once placed in the atmosphere, would rapidly diffuse. This became known as the "dilution is the solution" argument. Upper wind currents will spread the gases and pollutants over a very large area, and no one site will have a harmful concentration of pollution.

Many discount the reported effects of acid precipitation. Some doubt whether the acidification of our rain and lakes is actually occurring and, if it is, whether long-range transportation of pollutants is the cause. Many who refuse to accept the idea that acid precipitation is a major environmental threat are upset that power plant construction and the use of coal as a replacement fuel for oil are being held hostage to a scientific theory of dubious merit. Others, perhaps more accepting of the potential harm of acid precipitation, still wonder whether the preservation of a pristine environment is worth the cost of remaining dependent on foreign oil and costly expenditures for pollution control devices.

The recently developed standards for fossil fuel power plants will control sulfur oxide emissions from future power plants and, after 1995, begin to effect regional reductions of sulfur oxides and hence acid rain. This program, however, does not address continued emissions from existing plants over the next two decades. These older power plants are the major contributors to the acid rain problem. By some estimates nearly 90 percent of all sulphur oxides come from older power plants. The possible alterations for existing plants range from low-cost coal cleaning to retrofitting with stack gas scrubbers. Because coal can be burned cleanly, the solutions to the acid rain problem need not necessarily conflict with national energy priorities.

The Atikokan Power Plant Controversy

The Boundary Waters Canoe Area (BWCA), a wilderness unit within the Superior National Forest (Minnesota) and located along 176 kilometers (110 miles) of the Minnesota-Ontario border, occupies 439,093 hectares (1,085,000 acres) of characteristic northwoods terrain. The area varies from 16 to 48 kilometers (10 to 30 miles) in width. Over 1,900 kilometers (1,200 miles) of streams, portages, and foot trails connect the hundreds of pristine, island-studded lakes that make up approximately one-third of the total area. Few wilderness areas have been the focus of as much persistent concern for protection from human impact as has the BWCA.

The 1976 proposal by Ontario Hydro to build and operate a major coal-fired power plant north of the Quetico-BWCA wilderness complex led to concern that air quality and ecosystems in the area could be inadvertently degraded, in spite of the years of effort and the legislation designed to protect them.

In 1976 Ontario Hydro, a crown corporation established by the Ontario government, requested provincial approval to build an 900-megawatt, coal-fired electric generating station near Atikokan, Ontario. Permission to build the plant was received in 1977. The site is approximately 20 kilometers (12 miles) from the northern boundary of Quetico Provincial Park and about 55 kilometers (38 miles) from that portion of the U.S.-Canadian border which forms the northern edge of the BWCA in Minnesota.

Criticism of the project from Canadian and U.S. environmental organizations and individual scientists centered on the proposed plant's proximity to the Quetico-BWCA wilderness area and on the failure to include any scrubber technology in the plant's design. Critics also said that the Ontario Hydro environmental analysis document failed either to give substantial evidence for its claim that no vegetation damage would result from sulfur dioxide emissions or to treat adequately the problems of acid precipitation and deposition of pollutants in the Quetico-BWCA environment.

The Atikokan facility was originally to be staged in four 200-megawatt units, one of which was to be in service by 1984. The boilers for these units were to burn either low-sulfur subbituminous coal from Alberta or lignite from Saskatchewan. The proposed facility was to feature electrostatic precipitators to control particulate emissions, but no scrubbers would be used too minimize sulfur dioxide emissions. Planning for the Atikokan generating station began in 1974. U.S.-Canadian international negotiations on the Atikokan plant began in August 1977.

During this period Minnesota congressional representatives and several environmental organizations urged the Department of State to ask Canadian officials (1) to refer the matter to the International Joint Commission (IJC), with a moratorium on plant construction (to allow a comprehensive study of the plant and its impacts) or (2) to ask for installation of the best available scrubbers (90 percent efficient) similar to those already used extensively in Minnesota for new sources.

The U.S. negotiating team initially requested the installation of 50-percent efficient scrubbers. The Canadian representatives indicated that they could not, at that time, accept such a requirement. The negotiators then focused on discussing a referral to the IJC that would not include a construction moratorium, but would feature a program to monitor the plant's effects. The Department of State submitted proposed wording for such an IJC reference, and the Canadian Office of Foreign Affairs agreed to consider the proposal.

After several months, however, the Canadian Embassy issued a diplomatic note rejecting any International Joint Commission reference, citing as its reason "the lack of indication of any potential injury" to the United States, such injury potential being "the traditional basis for considering transboundary pollution questions" by the IJC. The Canadian team also concluded that since the existing studies predicted that concentrations of sulphur dioxide--the pollutant of major concern in the United States--would be far below injurious levels, there was no basis for considering installation of scrubbers.

It is difficult to describe adequately the BWCA's significance to the American public as a conservation, scientific, and recreation resource for the present and future. It is the only lakeland canoe unit of the U.S. wilderness system and one of the system's largest units of any kind. Embracing the largest remaining virgin forest in the east, it attracts more recreationists than any other wilderness area in the nation and lies within two days' travel of nearly 50 million people. As the last large unmodified northern coniferous forest ecosystem in the eastern United States, it has become the focus of much education and demonstration management in wilderness ecology, animal behavior, vegetation history, nutrient cycling, and aquatic ecosystems.

The attraction of the area appears not to be any single factor, but a combination of related ones: fishing and camping in a wild, unpolluted landscape. However, the evergreen forests, clear water and air, rock outcrops, and shallow soils that are the conspicuous ingredients of the BWCA landscape are all also unusually sensitive to acid precipitation. The expansive and relatively unspoiled terrestrial and aquatic ecosystems in the BWCA are the major reasons for its recognition as a unique resource in the United States. This recognition and uniqueness has led to a protective degree of legislative and citizen vigilance and, indirectly, to recent monitoring of air quality in northeastern Minnesota. Since August 8, 1977, the BWCA has been protected by U.S. Clean Air Act amendments that guarantee maximum "Class I" protection for parks and wilderness areas. The intent of Class I status is to assure long-term maintenance of air quality in an area at essentially the 1974-75 levels. Class I applies to areas, such as the BWCA, in which practically any change in air quality would be regarded as significant.

Complementing the BWCA is Ontario's adjacent Quetico Provincial Park, 453,258 hectares (1,120,000 acres) where logging, snowmobiles, and motorboats are banned. The importance of the BWCA to the United States has been greatly augmented by the forward-looking decisions made by Canadians regarding the Quetico Park, established simultaneously in 1909 with the Superior National Forest to create an international sanctuary. Approximately 90 percent of the people who visit and enjoy the resources of Quetico are U.S. citizens. Over the years the Quetico-BWCA area has come to be viewed as a single air, water, biological, and recreational resource.

The "Rainy Day Blues" Role Play

The "Rainy Day Blues" role play follows the general pattern and issues in the actual Atikokan power plant controversy. Several changes have been made to help focus student attention on the public policy issues and to simplify the decision-making process.

Three general options are examined in this role play. One group believes that the proposed Atikokan power plant should not be built. A second group advocates building the proposed plant as designed by Ontario Hydro. The third group believes the plant should be built, but only if certain additional steps are taken.

The fourth group of students makes up the International Regulatory Commission (IRC). The IRC is a fictional counterpart to the existing International Joint Commission, a U.S.-Canadian board whose jurisdiction extends only to transboundary water quality disputes. The IRC was created for this role play to facilitate the decision-making process. According to terms set forth in a fictional "Joint U.S./Canadian Treaty on Trans-Boundary Air Quality" (see data packet), the IRC is made up of three Canadians, three U.S. citizens, and a chairperson from another country in this hemisphere. It has the power to take testimony on an issue brought before it and make a binding recommendation.

Since the late 1970s, Ontario Hydro has decided to scale down the proposed plant by 50 percent to two 200-megawatt units. Space for the original four units will still exist at the plant site. Once this decision was made, the controversy calmed down but did not cease. Company officials note that the environmental impact will be cut by 50 percent to extremely low levels. Opponents insist that any additional pollution is harmful and that the plant remains unnecessary.

Handout 3b: ACID RAIN ACTIVITY TIMELINE

	Day 1	Day 2	Day 3-4	Day 5	Day 6	Day 7
International Regulatory Commission	--Participate in introductory activities --Receive role assignments, form groups --Prepare for preliminary hearing	--Conduct preliminary hearing --Prepare and distribute press release --Receive handout 3g, begin research	--Conduct research in order to prepare questions on alternative courses of action --Prepare for running commission hearing	--Compare research findings in class --Finalize preparations for commission hearing	--Conduct commission hearing --Listen to presentations of other groups --Question other groups on cost/benefits of alternative courses of action --Reach decision	--Discuss effects of decision --Participate in class discussion and debrief
Build the Plant as Designed Group Build the Plant with Modifications Group Don't Build the Plant Group		--Participate in preliminary hearing --Identify reasons for group's course of action --Begin research	--Research --Identify supporting evidence	--Compare research findings in class --Select spokesperson and three witnesses --Prepare presentations for hearing	--Make group presentations --Answer questions from from other groups --Listen to other groups' presentations --Ask questions of other groups	

HANDOUT 3c: INSTRUCTIONS TO GROUP LEADERS

YOUR PRIMARY TASKS ARE TO ASSEMBLE YOUR GROUP AND GUIDE THE GROUP IN PREPARING A LOGICAL ARGUMENT FOR ITS POSITION. HELP THE GROUP SELECT A SPOKESPERSON AND UP TO THREE WITNESSES WHO WILL BE CALLED ON TO SPEAK AT THE IRC PUBLIC HEARING. EACH GROUP MEMBER SHOULD PRESENT AND EXPLAIN AT LEAST ONE REASON FOR THE GROUP'S POSITION. YOUR GROUP SHOULD TRY TO PROVIDE AS MUCH STRONG EVIDENCE AS POSSIBLE TO SUPPORT ITS POSITION. BE SURE EVERYONE HAS LOOKED CAREFULLY AT THE AVAILABLE DATA. YOU SHOULD ALSO CONSIDER ALL THE CONSEQUENCES OF THE VARIOUS ALTERNATIVES BEING DISCUSSED.

Handout 3d: RISK ASSESSMENT

It is important to clearly understand the implications of the issue facing your group. One way of doing this is to assess the risks involved in building the coal-fired power plant at Atikokan, Ontario.

Use the following questions and information from your role cards to make this risk assessment.

1. What potential negative effects may result from the building of the coal-fired power plant at Atikokan, Ontario?

    a. Who will be likely to experience these effects?

    b. Where or how widely will these effects be experienced?

    c. How soon are these effects likely to be experienced?

    d. How easy will it be to reverse these effects? Why?

2. How great are these negative effects likely to be?

    a. How many people and what type are likely to be affected physically or psychologically?

    b. How great is the environmental damage likely to be?

    c. How costly are these effects likely to be?

3. What are the chances that these negative effects will actually occur?

Handout 3e: PRESS RELEASE

INTERNATIONAL REGULATORY COMMISSION CONSIDERS RISKS FROM ACID PRECIPITATION

At a preliminary hearing yesterday, the International Regulatory Commission discussed the potential hazards of a proposed coal-fired power plant at Atikokan, Ontario. Among the questions considered were:

- What are the likely negative effects?
- How great are these negative effects likely to be?
- What are the chances that these negative effects will actually occur?

Potential negative effects identified by various spokespeople at the hearing included. . .

There were speculations on the extent of these effects. Some of those discussed were. . .

Much of the discussion focused on the likelihood that these various effects would occur. General feelings included. . .

Handout 3f: RAINY DAY BLUES GROUP WORKSHEET

PART I: Participants

Name of Your Group's Spokesperson: ____________________

Name of Your Group's Witnesses:

____

____

____

Other Group Members:

____

____

____

____

PART II: A Recommended Course of Action

1. State clearly the course of action your group believes would be best to follow:

____

____

2. Based on the information presented in your role cards and the "Background Notes," what are all the possible reasons for your position? For example, if your group advocates building the power plant as proposed, its reasons may include:

--Acid rain is not a major problem in the functioning of the power plant.

--The power company has carefully selected the Atikokan site.

--These days we need to keep building coal-fired power plants to lower our dependence on foreign oil.

LIST YOUR GROUP'S REASONS IN THE SPACES ON THE LEFT-HAND SIDE OF PAGE 2 OF THIS WORKSHEET. EACH GROUP MEMBER SHOULD IDENTIFY AT LEAST ONE REASON.

PART III: Research

Find information in the library to support each reason you listed for question 2. ENTER YOUR REFERENCE ON THE RIGHT-HAND SIDE OF PAGE 2.

	Reasons	Supporting Information
A.	____________________	____________________
	____________________	____________________
B.	____________________	____________________
	____________________	____________________
C.	____________________	____________________
	____________________	____________________
D.	____________________	____________________
	____________________	____________________
E.	____________________	____________________
	____________________	____________________
F.	____________________	____________________
	____________________	____________________

PART IV: Costs and Benefits

1. Outline briefly the costs and benefits of taking the course of action recommended by your group. THIS INFORMATION WILL HELP YOU CLEARLY STATE ARGUMENTS FOR YOUR POSITION DURING THE IRC HEARING. To complete this section you will have to do careful research. Identify your references next to each cost or benefit. An example is provided for you here.

Example: Do not build the power plant.

Costs	Benefits
--Potential problem with meeting energy needs	--No addition to acid rain problems
--Potential loss of jobs in the Atikokan area	--Encouragement of conservation to meet energy needs
--Potential increase in utility rates	--Less harmful heavy metals in lake and drinking water

Your Group's Alternative Course of Action: ______________________________

____

____

Cost	Reference	Benefit	Reference

Use a separate sheet of paper if necessary.

Handout 3g: INTERNATIONAL REGULATORY COMMISSION GROUP WORKSHEET

Your group is charged with making a decision on the proposed construction of a coal-fired power plant at Atikokan, Ontario. You must decide what is to be done on this issue. How necessary do you consider this proposed power plant to be? How important are the potential risks of acid rain? Is it possible to build the proposed power plant and make all parties happy? Of course, other questions must also be raised and answered.

PART I: Alternative Courses of Action

As a group, you should clarify the possible courses of action which may be taken in this case. List these alternative courses of action below (remember, each alternative for regulation should consider WHAT, HOW, AND WHO):

1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

PART II: Questions for the International Regulatory Commission Hearing

During the IRC hearing, you will want to ask questions of each group to help clarify their arguments. This will help you make a good decision. Each role has several questions or concerns. These should be listed, along with other questions that come to mind, in the appropriate areas below. Some questions may be asked of more than one group. Finally, you will spend time researching answers to these questions and educating yourselves. You want to be knowledgeable decision makers. Write down the references that you think answer the questions on the worksheet.

ALTERNATIVE 1: ____________________

	Question	Reference
A.		
B.		
C.		
D.		

ALTERNATIVE 2: ____________________

	Question	Reference
A.		
B.		
C.		

D. ________________________ ________________

ALTERNATIVE 3: ____

	Question	Reference
A.		
B.		
C.		
D.		

PART III: Costs and Benefits

For each alternative presented during the meeting, outline the costs and benefits of taking that course of action. COMPLETE THIS SECTION DURING THE IRC HEARING. A partial example for one alternative course of action is provided for you. Be sure to add costs and benefits as they are mentioned by the groups and to ask for clarification where necessary. This will help you make your final decision.

Example: Do not build the power plant.

Costs	Benefits
--Potential problem with meeting energy needs	--No addition to acid rain problem
--Possible loss of jobs in the Atikokan area	--Encouragement of conservation to meet energy needs
--Potential increase in utility rates	--Less harmful heavy metals in lake and drinking water

GROUP 1, PROPOSED COURSE OF ACTION: ______________________________

____

____

Cost	Reference	Benefit	Reference

GROUP 2, PROPOSED COURSE OF ACTION: ______________________________

____

____

Cost	Reference	Benefit	Reference

GROUP 3, PROPOSED COURSE OF ACTION: ______________________________

____

____

Cost	Reference	Benefit	Reference

Use a separate sheet of paper if necessary.

Handout 3h: SUGGESTED RESOURCES ON ACID RAIN

Listed below are some journal articles, library resources, and contact organizations to get you started on compiling information for the upcoming IRC hearing. NOTE: Some of your best information will come from recent newspaper and magazine articles, so be sure to check the Readers' Guide To Periodical Literature, Magazine Index, and any newspaper indexes available in your school or local library.

GENERAL LIBRARY RESOURCES

Bibliography for 1985-1986 National High School Debate Topic: Water Policy. Bethesda, MD: American Water Works Association, 1985. An annotated bibliography of articles, newspaper stories, and conference papers.

Pollution. Boca Raton, FL: Social Issues Resources Series, Inc. (SIRS), 1985. A "vertical file" of journal and newspaper articles. Supplemented annually.

Facts on File. New York: Facts on File, Inc., 1985. A weekly digest and index of news, compiled from major national and international newspapers.

Annual Editions: Environment 84/85. Guilford, CT: Dushkin Publishing Group, 1984.

Annual Editions: Global Issues 85/86. Guilford, CT: Dushkin Publishing Group, 1984.

Taking Sides: Clashing Views on Controversial Environmental Issues. Guilford, CT: Dushkin Publishing Group, 1984.

Our Food, Air, and Water: How Safe are They? Editorials on File. New York: Facts on File, Inc., 1985.

Environmental Information Handbook. New York: Simon and Schuster, 1984.

Pollution Abstracts. Louisville, KY: Data Courier, Inc. A "readers' guide" to articles on pollution.

JOURNAL ARTICLES

American Biology Teacher 45(April-May 1983). Special edition on acid rain.

Babich, Haney, and others. "Acid Precipitation: Causes and Consequences." Environment 22(May 1980):6-13.

Bybee, Rodger. Acid Rain: What's The Forecast?". Science Teacher 51(March 1984):36-40, 45-47.

Bybee, Rodger. "The Acid Rain Debate." Science Teacher 51(April 1984): 50-55.

"Canadian Environmental Issues in Perspective." Environmental Education and Information, 3(July-October 1984):187-95.

Ohanian, Susan. "Will April Showers Kill The Flowers?". Learning 12 (April-May 1984):85-88.

JOURNALS AND PERIODICALS WITH ENVIRONMENTAL FOCUS

Environment

Environment Action Bulletin

National Geographic

Scientific American

CONTACT ORGANIZATIONS

Acid Rain Foundation. 1630 Blackhawk Hills, St. Paul, MN 55112

Alliance for Environmental Education, Inc. Suite 113, 1785 Massachusetts Ave., NW, Washington, DC 20036

Center for Environmental Education. 2100 M St., NW, Washington, DC 20037

Center for International Environment Information. 300 E. 42nd St., New York, NY 10017.

Department of the Environment. Ottawa, Ont. K1A 0H3

Energy Research and Development Administration. Office of the Assistant Administrator for Environment and Safety, Energy Research and Development Administration, Washington, DC 20545

Environmental Action Foundation, Inc. 724 DuPont Circle Bldg., Washington, DC 20036

Environmental Management Service. Place Vincent Massey, Hull, P.Q. (Mailing address: Ottawa, Ont. K1A 0E7)

Environmental Protection Agency. 401 M St., SW, Washington, DC 20460 (Publication: Is Your Drinking Water Safe? Pamphlet #170 35-61-OPA).

Environmental Protection Service. Department of Fisheries and the Environment, Ottawa, Ont. K1A 1C8

Sierra Club. 530 Bush St., San Francisco, CA 94108

Water Pollution Control Federation. 2626 Pennsylvania Ave., NW, Washington, DC 20006

Worldwatch Institute. 1776 Massachusetts Avenue, NW, Washington, DC 20036 (Publication: Postel, S., Air Pollution, Acid Rain and the Future of the Forest)

Handout 3i: HOW TO RUN AN INTERNATIONAL REGULATORY COMMISSION HEARING

1. Announce the purpose of the meeting at the beginning.

2. Strictly enforce time limits on each group.

3. In order to maintain control:

   --Have all comments addressed to you.

   --Call on people who raise their hands.

   --Give each group equal time as much as possible.

   --Stress the need for participants to refer to specific sources of information when presenting arguments.

   --Question group members, but don't squabble with them.

   --Have all presenters initially state their names, places of residence, if possible, and professions.

4. Your agenda should be:

   a. Build-the-power-plant-as-proposed group.

      (1) Group leader

      (2) Maximum of three additional spokespeople

      (3) Questions to that group from IRC members

   b. Build-the-power-plant-with-modifications group (same as above).

   c. Don't-build-the-power-plant group (same as above).

   d. General discussion and questions from IRC members.

   e. Concluding remarks (1 minute) from each group.

   f. IRC votes, then announces its decisions.

   g. Discussion of reasons for chosen course of action.

Handout 3j: ACID RAIN DATA PACKET

This data packet contains seven documents to help you prepare for the upcoming IRC hearing. These documents are: I, Facts About Scrubbers; II, Descriptions of Proposed Plant at Atikokan; III, Technical Glossary; IV, Areas of the United States that are Sensitive to Acid Precipitation; V, Site for Proposed Plant; VI, How Acid Rain Forms; VII, Joint U.S./Canadian Treaty on Trans-Boundary Air Quality.

I. Facts About "Scrubbers"

A. How Do Flue Gas Desulphurization "Scrubbers" Work?

The basic operation of a "scrubber" that removes sulphur gases from a coal power plant is simple. Limestone is ground up and mixed with water to form a "slurry." Gases from the coal furnace are passed over this limestone mixture. Limestone contains calcium, a base, while the sulphur dioxide (SO_2) from the furnace is acidic. The limestone neutralizes the sulphur dioxide in the exhaust gases, which are then sent up the smokestack.

Eventually the limestone loses its neutralizing ability and must be disposed of and replaced with a new limestone mixture. Scrubbers add to the cost of a power plant in several ways--for instance, installation of special equipment, maintenance, and disposal of used limestone slurry. However, today's scrubbers and new ones being designed can remove the bulk of the harmful SO_2 produced by burning coal.

B. Costs of Scrubber Application at Atikokan Power Plant

1. The cost of providing the capability to install SO_2 removal equipment at some future date after the station has been placed in service.

Assuming only minimum provision (for example, space provision), the cost would be negligible.

2. The cost of reducing SO_2 emissions from the station by 50 percent.

This estimate assumes:

--that the SO_2 removal equipment is designed and installed along with the rest of the station and is not backfitted at a later date (a backfitted system might cost 10-20 percent more).

--that to achieve a 50-percent reduction in SO_1 emissions, 56 percent of the flue gas from each unit is scrubbed with an SO_2 removal efficiency of 90 percent (i.e., 90% x 56% = 50%).

--that the station consists of two 200-MW units.

The capital costs of this system, including the cost of the generating capacity required to power the system, would be approximately $37 million at 1980 price levels.

The cost of operating and maintaining the system, in addition to the capital charges, would be approximately $5 million per year, assuming a 60-percent annual capacity factor of the power plant.

3. The cost of reducing the SO_2 emissions from the station by 90 percent.

This would require full scrubbing on both units. Again assuming limestone scrubbing and that the system is not backfitted, the capital cost would be approximately $66 million at 1980 price levels.

The cost of operating and maintaining the system, in addition to the capital charges, would be approximately $8 million per year, assuming a 60-percent capacity factor of the power plant.

II. Description of Proposed Plant at Atikokan

1.1 Introduction

This document describes the proposed project, its alternatives, and the existing environment, and assesses the environmental influences which would occur due to the construction and operation of the proposed 800-MW, fossil-fired generating station, Atikokan GS, on a site northeast of Atikokan. The proposed generating station will be designed, constructed, and operated using proven technology and will have the most up-to-date control features to minimize any environmental impact.

1.2 Proposed Project

The planning and development of this project has been underway since 1974; therefore the regulations of the new Environmental Assessment Act, which are to be released early in 1976, do not apply and this has been agreed to by the Ministry of the Environment.

The proposed site is approximately 7 miles (11 km) northeast of Atikokan near Marmion Lake and 12 miles (19 km) north of Quetico Park.

The normal generating capacity of the proposed station will total 800 MW from four 200-MW units.

The first unit will be completed in April 1983 and the remaining three units at successive six-month intervals. It may prove desirable to defer the third and fourth units.

The capacity factor of the station is expected to be 70 percent for the first 10 years, 50 percent for the second 10 years, and 30 percent for the last 10 years of operation.

1.3 Air

West to northwest winds are dominant in winter, shifting southeast in the spring. During the summer and fall the prevailing winds gradually shift back to the northwest.

Emissions will be carried in the direction of Atikokan only about 10 percent of the time, and the northern boundary of Quetico Park for about 29 percent of the time.

Existing air quality beyond the immediate area of the mines is generally well within the provincial air quality criteria for suspended particulate, sulphur dioxide, and nitrogen oxides.

The proposed height of the stack and other design features are such that the calculated maximum ground level concentrations of sulphur dioxide will normally be approximately 25 percent of the regulatory design guidelines set for the station.

Apart from sparsely distributed white pine, the only other local vegetation considered to be sensitive to air emissions is trembling aspen and some species of lichens.

Emissions of sulphur dioxide from the proposed generating station will contribute to an increase in long-term background levels from all sources, natural included. Some injury may become apparent in certain species of lichens due to this increase in long-term background sulphur dioxide levels. Other vegetation is not expected to suffer any measurable damage.

Based on a review of effects of other known sources of sulphur dioxide emissions, no measurable increases in precipitation acidity are expected to occur.

The deposition of sulphate from stack emissions into the lakes of Quetico Park will contribute only a small proportion to the present naturally occurring levels during the lifetime of the station. No deterioration in the general water quality of these lakes is therefore anticipated as a result of sulphur dioxide emissions from the proposed generating station.

Calculated sulphur dioxide levels are not expected to influence the health of residents in the Atikokan area.

1.4 Community

Regional development has been historically based on the resources extraction and processing industries. Populations have been declining in the area. It is expected, however, that a population increase of 460 to 550 will occur in 1976 due to increases in Pluswood and Caland Ore employment opportunities. Further increases will occur when construction staff enter the area.

Industrial activity in the area is virtually confined to lumbering and iron ore processing. Tourism is expected to increase in the area. Agricultural activity is negligible.

The number of construction staff will reach a peak of approximately 1165 in 1982. This influx may stabilize conditions in the area against effects which would result from the possible phasing-out of a mining operation. No undue stress should be placed on educational facilities, hospitals, internal transportation, and recreational facilities. However, there may be some strain on housing stocks should mine closure be delayed. Upgrading and expansion of municipal and community services will be required but should coincide with improvement programs already planned.

As much as possible of the skilled labor requirements of the project will be met in the Northwestern Region.

2.1 Need for Plant

As indicated in this document, a number of alternatives for supplying power to the West System have been studied. Of these alternatives, the study concerning the installation of further transmission between the East and West Systems is still underway and this could result in modification to the timing, unit size, site capacity, and fuel, or may prove to be a viable alternative to the proposed development of Atikokan GS. If the feasibility of constructing further transmission between the East and West Systems were to be confirmed, the proposed installation at Atikokan would have to be reviewed. If changes were required, work on this proposed project would be stopped and Ontario Government approval sought for a modified installation. Furthermore, power purchases from Manitoba Hydro or Saskatchewan Power Corporation could affect this proposed project.

In May 1982, the firm purchase of power from Manitoba Hydro is scheduled to reduce to zero so that additional sources of power could be required in the spring of 1982. It is possible that some interim measures might be required between May 1982 and April 1983. These could comprise purchases of power and/or the installation of combustion turbines.

Following the proposed installation of the four units at Atikokan GS, additional capacity could be required as early as 1987. This additional capacity could be obtained from a new generating station on a new site, or from extensions to the Atikokan or Thunder Bay stations. Nuclear generation in the West System is not possible until about 1988 or 1989 and it would have to be installed at a new site.

2.2 Alternatives to the Project

2.2.1 The Alternative of Not Providing Generation

Eight-five percent of the electrical demand in the West System is industrial. Thus, changing economics or tax conditions, particularly with respect to the resource extraction industries, could significantly affect the growth in electrical load. Ontario Hydro believes that the load will grow and the failure to add capacity in 1983 and 1984 would result in either inadequate supply or greatly reduced reliability.

2.2.2 Alternative Power Sources

(a) Purchase from Manitoba Hydro
(b) Saskatchewan Power Corporation

The possibilities of purchasing firm power from Manitoba Hydro or Saskatchewan Power Corporation are continually under consideration.

A 500-kv line from Manitoba to the United States is scheduled for completion by May 1980, but its construction has not yet been approved. If the line between Winnipeg and the United States is constructed, Manitoba Hydro may be able to make power and energy available to Ontario Hydro in the early 1980s.

Saskatchewan Power Corporation has indicated in preliminary discussions that it is interested in sales to Ontario Hydro. Such purchases from Manitoba Hydro and Saskatchewan Power Corporation could be a viable alternative for 1982 and 1983.

2.2.3 Alternative for Site Location

For a fossil-fueled generating station, the Atikokan site is preferred, both environmentally and economically, over all other sites considered by Ontario Hydro. There is also strong support for this location by the municipal administration and residents of Atikokan.

III. Technical Glossary

Acid Rain - A popular term used to describe precipitation that is more acidic than "clean rain" (which has a pH of 5.6). Snow can also be acidic.

Acidify - To become more acid than the natural state, usually through man-made influences

Air Quality Standards - Standards set by government to control air pollution. Usually in terms of parts per million (ppm) of some chemical, gas, or other substance.

Buffer - To partially or entirely neutralize acidic precipitation in soils or lakes.

Buffering Capacity - In soils or lakes, the degree to which acidification can be offset. Usually a measure of the calcium or limestone in the region.

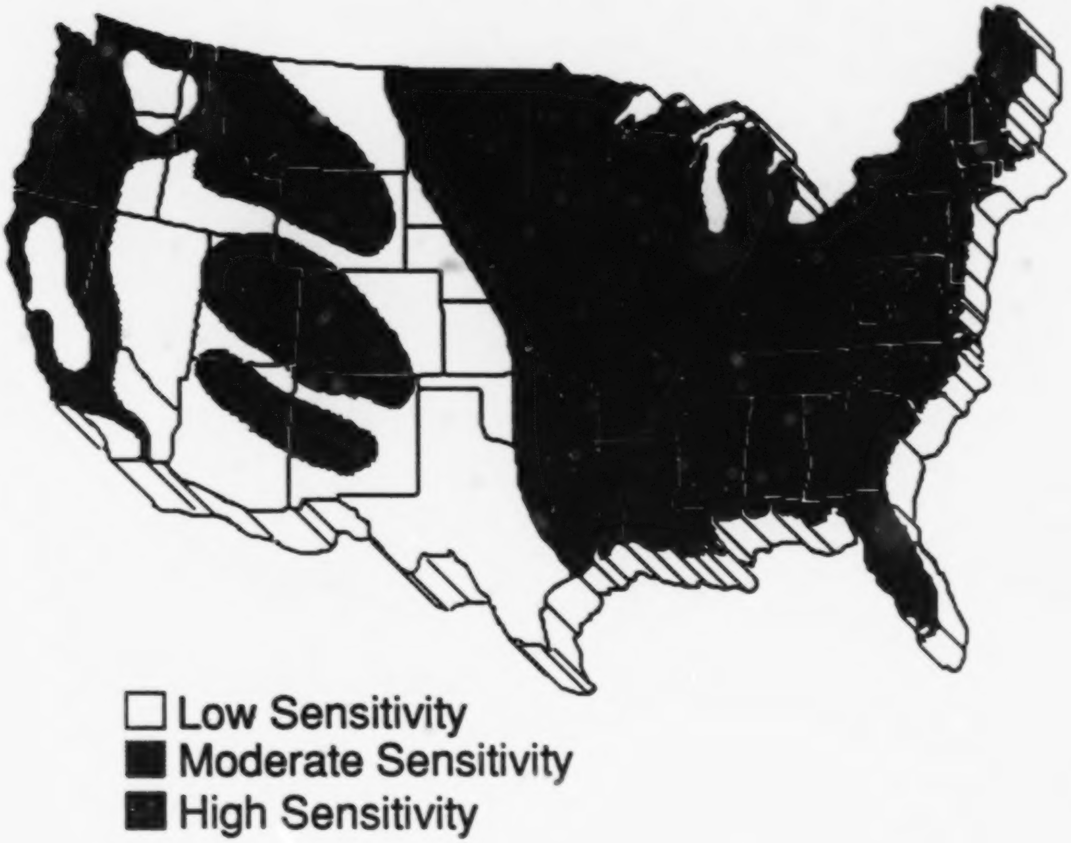
Deposition - The process by which pollutants are removed from the atmosphere and deposited on land, plant, or water surfaces. Dry deposition refers to dust particles, wet deposition to rain and snow.

pH - A scale used to measure relative acidity or alkalinity. pH below 7 indicates acids, above 7 alkalines; 7 is neutral. A change of 1 (from 7 to 6, for example) means a 10-fold increase in acidity because the pH scale is logarithmic (see Data Card 11).

Sulphur Dioxide (SO_2) - A colorless gas generally created by burning of fossil fuels. A major component of acid precipitation.

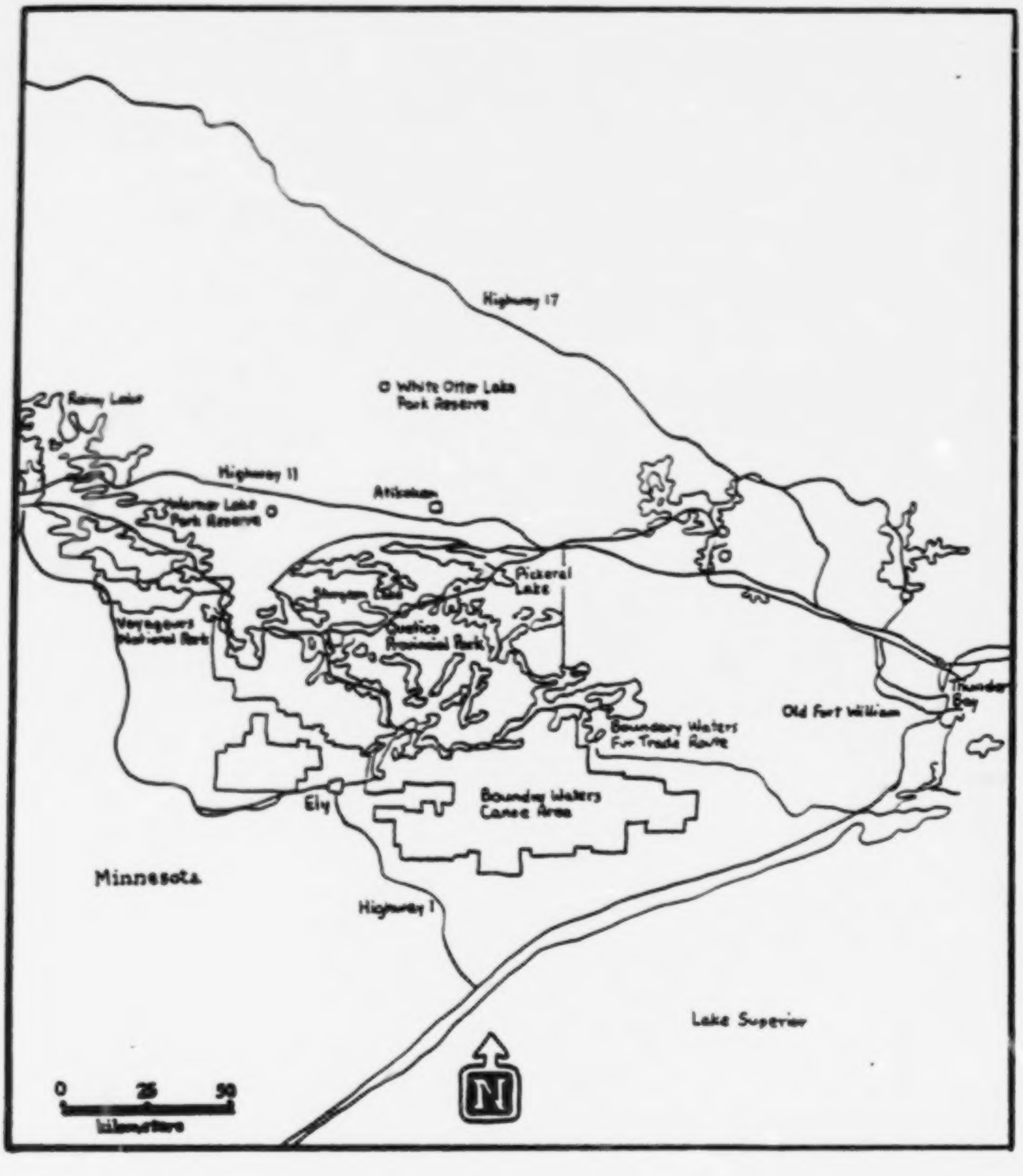
IV. Areas of the United States that are Sensitive to Acid Precipitation

The map below shows areas of the continental United States that are believed to be sensitive to acid deposition. This map was constructed by examining such factors as chemical composition of soils, climatic patterns, and types of vegetation within a given geographical area. This and other maps will be improved and updated as additional information becomes available through research projects that are presently underway.



From "Research Summary: Acid Rain," USEPA Office of Research and Development, October 1979.

V. Site for Proposed Plant


Highway 17
White Otter Lake Park Reserve
Rainy Lake
Highway 11
Atikokan
Volamar Lake Park Reserve
Sturgeon Lake
Pickerel Lake
Voyageurs National Park
Quetico Provincial Park
Thunder Bay
Old Fort William
Boundary Waters Fur Trade Route
Ely
Boundary Waters Canoe Area
Minnesota
Highway 1
Lake Superior
N
0
25
50
kilometers

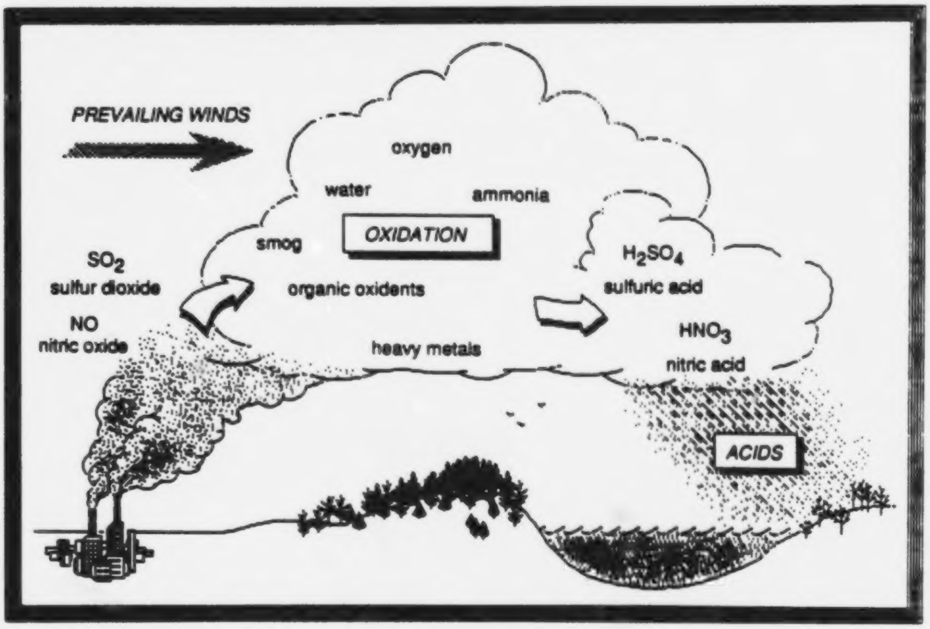
This map shows the location of Atikokan, Ontario, and the three wilderness areas surrounding it: Quetico Provincial Park, Voyageurs National Park, and the Boundary Waters Canoe Area.

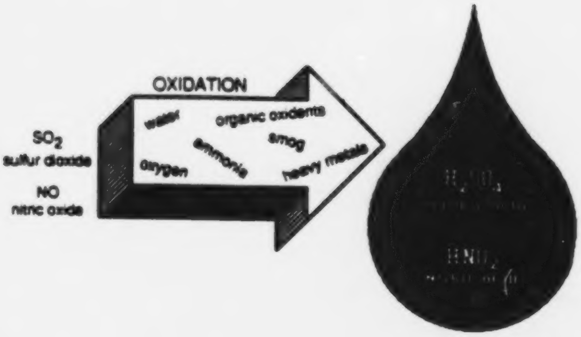
From "The Possible Environmental Effects of the Atikokan Coal-Fired Generating Station on Quetico Park," by Mario A. Madau, March 1979, p. 96.

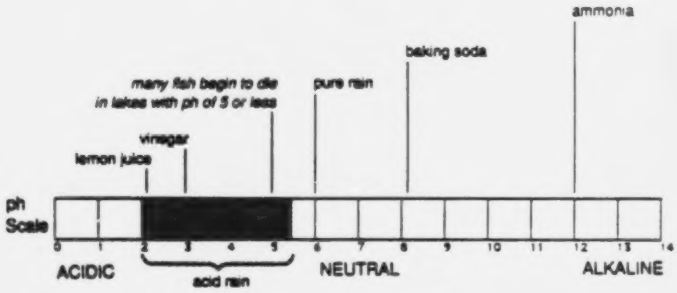
BEST COPY AVAILABLE

VI. How Acid Rain Forms

Acid rain forms when pollutants such as sulfur oxides and nitric oxides are converted into sulfuric and nitric acid through the process of oxidation in the atmosphere.


PREVAILING WINDS
oxygen
water
ammonia
OXIDATION
smog
SO_2
sulfur dioxide
organic oxidents
NO
nitric oxide
heavy metals
H_2SO_4
sulfuric acid
HNO_3
nitric acid
ACIDS


OXIDATION
SO_2
sulfur dioxide
NO
nitric oxide
water
organic oxidents
ammonia
smog
oxygen
heavy metals
H_2SO_4
HNO_3



The pH scale measures the strength of an acid; the lower the pH, the higher the acid. pH 1 is very acid, pH 7 neutral, and pH 14 alkaline. Rain is acid if the pH is less than 5.6. In the 1930s, the pH of Adirondack lakes was about 6.6. By the mid-1970s, the pH had dropped to about 4.9.

VII. Joint United States/Canadian Treaty on Trans-Boundary Air Quality

SCOPE OF TREATY AS REGARDS ACID PRECIPITATION

Annual and short-term precipitation in the boundary regions of the United States and Canada shall not cause undue damage to aquatic and terrestrial resources, human health, or physical structures.

ENFORCEMENT PROCEDURES

If either country makes a complaint that is not satisfactorily responded to, that party may request a hearing and judgment by the International Regulatory Commission (IRC). The IRC shall be authorized to seek information, hold public hearings, and make a binding judgment on matters brought before it. The IRC may apply those legislative standards from either federal government that are most applicable and may do so in a binding fashion.

The overall goal of the IRC in enforcing this treaty is to protect the quality of the environment while encouraging positive relations between the two nations.

Jake Deerstalker

You are a 28-year-old Ojibwa Indian who has lived all of your life in Canada near the Quetico Provincial Park. For the past several years, you have been active in several Native American rights movements and you have some strong feelings about how your people have been treated by whites. On the question of building the power plant at Atikokan, you stand firm: the plant should not be built, no matter what protections are promised. After all, can the promises of the whites be trusted?

The power plant at Atikokan would be one more white burden on the Indian lifestyle. Your people depend on fish as a major portion of their diet. Recent reports have shown increasing amounts of dangerous chemicals in the flesh of fish. In addition, mercury and other "heavy" metals are also being found in fish caught in northern lakes. You know that as acid concentrations increase in lakes, more "heavy" metals like mercury are drawn out of sediment on the lake bottom and go into solution in the lake water. The mercury then ends up in the fish, which your people eat. Mercury can cause serious brain damage and--in large enough quantities--death. By increasing acid precipitation, the proposed power plant will make this problem more serious.

Another reason for your opposing the power plant is your belief that people and nature should live in harmony. How can people propose a plant that will increase acid precipitation that could threaten all fish life in the many sensitive lakes in northern Minnesota and Canada? If the fish are killed, your people will be left without their primary food source. It's time the whites started conserving nature instead of destroying it.

B. C. Swensen

At 32, you have a long history of political and environmental involvement. You protested against the Vietnam War while in college and helped organize the first Earth Day celebration in 1970. Recently, you moved to northern Minnesota with your family and became involved in the Friends of the Boundary Waters Canoe Area (BWCA) organization. Your position is that the building of a power plant at Atikokan is both unnecessary and harmful. You have several reasons for taking this hardline stand.

In this era of the "energy crisis," it bothers you that citizens and governments continue to demand and plan more power-generation stations. Rather than building more polluting power plants that scar the land, we should focus on conservation and development of nonpolluting energy sources like the sun and wind. Neither of them cause acid precipitation.

The other major reason you oppose the Atikokan plant is that the BWCA is a precious natural resource that must be preserved. The inevitable acid precipitation, whether lots or little, will hurt the forests, affect the soils, and ultimately kill the fish in many lakes. The U.S. Environmental Protection Agency (EPA) has classified the BWCA a class I wilderness area. This means that there is to be no impact by humans in that area; it is to be protected as a wilderness refuge. Unfortunately, some acid precipitation is already coming into the BWCA from other sources. The increase in acid precipitation that the Atikokan power plant would cause must be prevented. Allowing the acid level of lakes in the BWCA to increase to the point of killing fish doesn't sound like protecting the wilderness to you!

The risk of destroying this precious nature preserve is just too great. You want your children to be able to enjoy the BWCA as you found it--wild, pristine, and with lakes teeming with fish.

Larry Gorst

You are a 46-year-old environmental scientist specializing in weather transportation of pollution. About five years ago, you began to further specialize in acid precipitation and are now one of the leading experts on the subject. You live in Duluth, where the U.S. Environmental Protection Agency (EPA) laboratory is located. While your interest in this question is primarily scientific, you and your family do take camping trips in northern Minnesota and Canada and you love the area. As the author of a major study on the impact of the Atikokan plant on the ecology of the Boundary Waters Canoe Area (BWCA), you think your position should be carefully listened to. You believe that the plant should not be built.

The BWCA's geology makes it very susceptible to acid precipitation. It lacks the limestone base that neutralizes acids and thus even small amounts of acid precipitation can have large consequences. Without question, the Atikokan plant will increase acid precipitation (probably by 15-30 percent); much of this will fall on the BWCA. The acidity of lakes and soil will increase, threatening many plant and tree species. These clear risks must be confronted. In addition, even if all acid precipitation stopped, the reversibility of the effects is questionable.

You are reminded of the story of the straw that broke the camel's back. By itself, the camel could carry the straw, just like the BWCA can handle a small amount of acid precipitation. However, every straw added to the camel's burden increases the weight of it's load. The burden of acid rain on the BWCA is already great; if we continue our current activities, the BWCA won't be able to handle any more acid precipitation and dramatic damage will take place in lakes, forests, and soils. The burden of the camel is getting greater; by opposing the Atikokan power plant, we lessen the burden on the BWCA. And remember the BWCA, like the camel's back, isn't easily repaired once broken.

Anita Ruiz

At the age of 40, you feel that you have had two lives. Married early, you raised your three children while your husband worked as a manufacturer's sales representative. About ten years ago, you went back to school, majored in business, and are now a vice-president in charge of marketing for a moderate-size manufacturer of household appliances. Just two years ago, you were elected to the board of the Minnesota Chamber of Commerce. After careful consideration, you have decided that the proposed power plant at Atikokan should not be built.

As a member of the Chamber of Commerce, you are working to increase business and economic development in Minnesota. The Atikokan plant could jeopardize such development. Presently, there are 24-hour limits for the amounts of pollution that can be put into the air. Once this limit is reached, the U.S. Environmental Protection Agency (EPA) insists that industrial plants be shut down briefly until pollution levels decline. The power plant at Atikokan, especially if built without pollution control devices, will add to the background pollution in Minnesota. If the 24-hour limit were reached, Minnesota factories would have to close because the EPA has no control over a power plant in Canada.

The results of this would be severe: lost wages and profits in Minnesota, higher risks associated with opening new plants in the state (for fear they would have to shut down periodically), and slower development of copper and nickel deposits in northern Minnesota because they will add to pollution. A further economic cost would be a decline in the resort business if acid precipitation hurt the ecology of the Boundary Waters Canoe Area (BWCA).

All in all, this plant isn't necessary and could have a significant impact on the economy of Minnesota, not to mention its quality of life.

J. O. Chinsolm

At 25 years of age, you moved with your spouse and newborn child to the small community of Atikokan. You work in the local grocery store; your spouse is an artist who works at home and cares for the baby. After a great deal of thought, you moved to Atikokan for its small size, closeness to scenic wilderness, and the chance to create a more self-sufficient lifestyle. Now Ontario Hydro wants to build a large coal-fired power-generating station almost in your backyard. You strongly oppose construction of the plant because of the impact it would have on the local environment.

Your opposition to the plant is based on several specific concerns. First, you fear that the increased acidity of lakes in the region due to acid precipitation from the plant will result in higher levels of dangerous mercury in the drinking water and fish. Recently you read about the many people who died from mercury poisoning in the city of Minimata, Japan; the fish they ate and the water they drank were the sources of the fatal mercury. Certainly electricity is not needed so much that our precious drinking water supplies should be risked!

A second concern is related to recreation in nearby Quetico Provincial Park, Voyageurs National Park, and the Boundary Waters Canoe Area (BWCA). Your family and friends spend much of the year camping, hiking, fishing, and cross-country skiing in those parks, and you would hate to see them deteriorate. From the reading you've done, you know the proposed plant will increase the acid precipitation load. This could result in fish dying, plants not being able to grow, and forests dwindling. This is far too high a price to pay for electricity that probably isn't vitally needed.

Finally, you worry about the quality of the air you breathe. An article you read put it best--the Atikokan power plant will put out "SOX, NOX, and ROCKS." This means it will emit sulphur gases (sox), nitrogen oxides (nox), and solid particles (rocks). All of these will lower the air quality in and around Atikokan. No, the plant Ontario Hydro is suggesting would be better not built at all.

Rudy Gilboy

As the 55-year-old president of the Midwest Association of Sport Fishing Fanciers (MASFF), you represent several hundred people who actively support recreational fishing. You have fished for most of your life, the majority of the time in northern Minnesota and Canada. You are nervous about the fate of the sport you love. As if other kinds of pollution weren't bad enough, now acid precipitation threatens the very existence of fish in many lakes. Because you know the proposed power plant at Atikokan will add to the acid burden in northern Minnesota and Canada, you strongly oppose its construction.

Research done by your organization shows that the lakes in the Boundary Waters Canoe Area (BWCA) and other parks in the region are similar to those in Norway and upstate New York. Acid precipitation, has already killed the fish in hundreds of lakes in both of those areas. This is clearly the fate of lakes in Minnesota and Canada if nothing is done to bottle up the causes of acid precipitation. The pH is already approaching critical levels for the survival of fish stocks.

Sport fishing is a valuable economic activity bringing many tourist dollars into Minnesota and Canada. If controls aren't soon implemented, a vital economic resource will be lost. New York state estimated its losses from acid-precipitation-caused fish kills at approximately $1 million in 1977. In addition, suggestions that lime could be added to lakes to absorb the acidity or acid-resistant fish could be bred are ridiculous. These "solutions" would be expensive, probably have other harmful effects, and would not solve the basic problem facing our environment. You feel that those who fish and those who don't must stand together to protect the lakes that are such an important part of the natural system. The plant should not be built.

P. B. Gaston

You are known as "The Fern Person" to residents of the Atikokan area. Your background is in philosophy, but over the past six years--since you were 25--you have become one of the area's best-known experts on local plants, ferns, and mosses. Some call you eccentric, but you are only trying to better understand and relate to nature. You are working with the Friends of the Boundary Waters Canoe Area (BWCA) in opposing construction of the proposed power plant at Atikokan.

Probably your strongest argument against the power plant is the risk it presents to the mental well-being of people in the area. Most of them enjoy the wilderness of the BWCA and Quetico Provincial Park. You believe that people actually need to know there are unspoiled wilderness areas they can go to in order to get away from "civilization." The power plant would negatively alter the wilderness: hikers and campers would see an ugly plume of smoke; acid rain would harm the plants and lakes. Getting away from civilization would no longer be possible.

Although many others focus on the damage to lakes from acid rain, you know that major damage would also take place in the plant world. White pine, aspen, and birch trees are all very susceptible to damage from acid rain, as are ferns and mosses. You shudder to think that we might be sacrificing some species of plant or moss for just a little more electricity. Humans do not have the right to wipe out any form of life.

Alicia Johnson

You are the 34-year-old co-chairperson of the Friends of Quetico Organization. Your group acts as a watchdog to ensure that Quetico Provincial Park remains in its present wilderness state. You've been a resident of Ontario for your entire life and feel strongly about preserving the few pockets of wilderness that are accessible to people in the larger Canadian cities. Quetico is just such an area. For several reasons, you are dead set against construction of the proposed power plant at Atikokan.

The proposed power plant would be a mere 12 miles from the Quetico Provincial Park, far closer to it than to the Boundary Waters Canoe Area (BWCA) which is 55 miles from Atikokan. Quetico would thus receive a higher concentration of solid particle pollution and an extremely high concentration of sulphur dioxide (SO_2), which forms the major component of acid precipitation. Graphs from the U.S. Environmental Protection Agency (EPA) clearly show this to be so. Thus, the risk to Quetico in terms of plant and lake destruction is immense. You feel it is important to remind people that the lakes, plants, and trees in Quetico Park are just as sensitive as those in the more highly debated BWCA.

A second reason for opposing the plant is much broader. Air quality in much of Canada is getting worse. Another coal-fired plant will be another source of air pollution for central and eastern Canada. Stopping the Atikokan plant won't make air pollution go away, but it will be a strong statement that dirty air must be dealt with. You feel that this problem, which you read about in a speech by John Fraser, is significant. All possible efforts must be made to clean up Canada's air for future generations to breathe.

R. A. Kowolski

You are a 34-year-old U.S. resident and environmental scientist, although you once wanted to be a bush pilot in Alaska. Your love of wilderness and wildlife is deep and sincere. Yet as a scientist you can objectively look at the many sides of any complex issue. The debate over the building of a coal-fired power plant in Atikokan is one such issue. After looking at the data and the various issues, you support building the plant with certain modifications and provisions. Essentially, you feel the plant should be built with an extensive air quality/acid rain monitoring system and the capacity to add "scrubbers" should the pollution get out of hand. These modifications would reap the greatest benefits for the most reasonable costs.

Acid rain is a major problem that must not be underestimated. Lakes in New York state are rapidly becoming acidified and "dying," and New Englanders are complaining about forest and lake damage due to acid rain. Any decision on the Atikokan plant must consider threats to the Boundary Waters Canoe Area (BWCA). Lakes and forests are pretty hard to "remake" once they've been damaged.

Your research and reports you've read seem to indicate that the Atikokan plant, even at 400 megawatts, will have some impact on acid rain in the BWCA and other park areas. The current research doesn't indicate a major impact. This does not mean that irresponsible action should be taken. A quality monitoring system would not be extremely expensive and would have several benefits. It would alert scientists to potential acid rain problems from the Atikokan plant and would help increase our general knowledge about how acid rain is formed and transported.

Building the plant with "scrubber" capability would allow these pollution control devices to be installed swiftly and economically, should they prove necessary. The combination of monitoring systems and scrubber capacity is the most sensible solution to the Atikokan controversy, permitting swift detection and response to any harmful effects.

Jacques Reynold

You are 39 years old and have lived your entire life in Canada, most of it near Atikokan. You love your country but also have a fondness for the United States. Your family has taken many canoe and camping trips in the Boundary Waters Canoe Area (BWCA), Quetico Provincial Park, and Voyageurs National Park so you know the areas in question well. When it comes to the issue of whether to build a coal-fired power plant at Atikokan, you are a realist. You support building the plant with certain precautionary measures.

Acid rain is, without question, a problem in both nations. Just look at eastern Canada, New York state, and even the Colorado Rockies. However, your mining job near Atikokan is going to end soon when the company halts operations. Building of the power plant would give you job security. Therefore, to balance the costs and benefits, you think some form of pollution control on the plant is necessary. You believe these controls should include an air quality monitoring system to detect dangerous increases in acid-rain-producing SO_2 gas and the capacity to add "scrubbers"--the devices that neutralize SO_2 gas. According to Ontario Hydro, this would add almost nothing to the cost of the plant. Yes, these controls would probably raise the rates for electricity, but such a trade-off is the most realistic position.

In reality, the "scrubbers" will probably prove unnecessary because of an old saying you once heard: "Dilution is the solution." This means that the gases released from the proposed Atikokan plant will be diluted by all the air in the area. By the time the gases reach areas like the BWCA, they will be so weak they won't harm anything. If this doesn't occur, the monitoring system will alert scientists and the "scrubbers" could be added. Once again, this is the most realistic outlook for all concerned: the environmentalists, the power company, the governments, and you and your fellow workers in and around Atikokan.

Role Card RDB-11

Libby Johansson

Nearly 20 years ago, as newlyweds, you and your late husband opened the Shangri-La Resort in Minnesota right next to the present Boundary Waters Canoe Area (BWCA). At 43, you now manage the resort alone and have strong feelings about the proposed coal-fired power plant at Atikokan. The problem is that the feelings are strong on several sides of the issue. You have therefore decided to argue for a compromise position, a decision that will make the largest number of people feel satisfied. The proposed plant should be built with at least 50-percent "scrubber" pollution control capacity. The "scrubbers" would remove enough SO_2 to prevent acid rain from being a problem.

The Shangri-La Resort has always drawn a large number of guests from Canada. Construction of the proposed Atikokan power plant will bring many construction workers into the area. Many of these workers and their families will want to stay in your comfortable facilities. Thus you, your business, and other local businesspeople will receive economic benefits. When construction is completed, many will stay on in Atikokan to run the power plant. They, too, will help the regional economy and your bankbook.

Acid rain, however, is a real worry. The Shangri-La is famous for the fishing and camping trips it organizes. If fish start dying and plants start getting sick from acid rain, you are in big trouble. You therefore support "scrubbers" that will remove 50 percent of the acid-rain-producing SO_2 gas. The cost would not be small--about \$37 million to install and \$5 million per year to maintain--but it would only add a small amount to the average customer's electric bill. Although scientists say that the BWCA doesn't face a serious acid rain problem, you can't take chances where your business and livelihood are concerned. The 50-percent effective scrubbers are the best balance of cost and benefit: a reasonable reduction of the threat of dangerous acid rain.

A. L. Mukdananda

At 29, you are a junior member of the U.S. Environmental Protection Agency's (EPA) staff devoted to international scientific issues. Born in India and educated in England and California, you now reside in Washington, D.C. Since you have lived in many countries, you love dealing with environmental issues that cross national boundaries. The situation with the proposed coal-fired power plant at Atikokan is therefore just your "cup of tea." You have done research on the various potential problems raised by residents, other government officials, and power company representatives. The position you feel is the most responsible and realistic is to build the proposed plant with 50-percent effective "scrubber" pollution control devices and a good air quality monitoring system. Such a decision makes the most sense in terms of economics, the energy crisis, and managing the risks of acid rain.

You see two major issues that must be understood in this controversy. First, the condition of United States/Canadian relations must be protected. The two countries have worked well at resolving environmental problems that crossed their borders. An example is the formation of the International Joint Commission (IJC) that works to keep the Great Lakes clean. The Atikokan controversy must become an example of international cooperation on the problem of acid rain. Since almost 80 percent of the acid-rain-producing gases in Canada come from the United States, we can't realistically force excess pollution controls on the Atikokan plant. Fifty-percent effective SO_2 gas "scrubbers" are therefore the best compromise. They would handle enough SO_2 gas to keep potentially dangerous acid rain from forming and threatening the fragile Boundary Waters Canoe Area (BWCA) and other wild regions.

The second major issue is the energy crisis and its relation to the environment. Because of the energy shortage, more and more energy is going to be produced from coal in the future. An economical and realistic solution like air quality monitoring and 50-percent effective "scrubbers" is more acceptable to the general public that wants energy and doesn't care about acid rain. That group won't accept 90-percent removal of harmful gases or never building the plant, even though those might be the best long-run choices. Your position best allows the two governments to work together, the environment to be protected from acid rain, and the energy needs of the public to be met.

John Tipple

Your nickname, "Hooks," is well-deserved. You have been fishing successfully for your entire 52 years of life. As a boy, your grandfather taught you to catch the big ones in the many lakes of the Boundary Waters Canoe Area (BWCA). Now a successful Minneapolis lawyer, you still spend many weekends fishing in the BWCA. Your position on the proposed coal-fired power plant in Atikokan is simple and clear: the plant should be built without delay and with 90-percent effective pollution control "scrubbers."

Acid rain is unquestionably a problem. Statistics show lakes around the world losing their fish stocks due to lowered pH caused by acid precipitation. New York state is only one example. You also believe that the energy crisis is real. Sure, oil companies may be making a huge profit, but only a fool would believe we have an inexhaustible supply of energy. Your position on the Atikokan plant best balances the potential costs and benefits that are involved in the issue.

With-90 percent effective "scrubbers" to handle the SO_2 gases that are the primary cause of acid rain, the power plant will not in any major way threaten the ecology of the BWCA. With acid rain reduced by 90 percent, the chances of mercury poisoning from acidified lake water are also slight. These two important risks would no longer be likely to occur. In addition, the energy needs of Canada and the United States become easier to meet. If a pattern of building coal-powered plants with good, effective pollution control is begun, we might just lick the energy crisis without killing the environment.

Although the cost of removing 90 percent of the SO_2 would increase energy rates, that is a cost we must bear--whether in Canada or the United States--for producing energy without causing acid rain. After all, you want to continue fishing and maybe teach your grandchildren to do so. Who can put a price tag on the beauty of clean lakes teeming with healthy fish?

Sharon Hoge

You are a 47-year-old first-term Senator from Minnesota. You love serving the people of this great state and are running an active reelection campaign. Joining you on the campaign trail across the state are your husband and three grown-up children.

Since the first oil troubles in the 1970s, you have believed in a more vital and active national energy program, and have fought for it in Congress. After all, it can get awfully cold up in the northwoods in the winter! The two cornerstones of your energy ideas have always been strong conservation and a greater use of U.S. coal reserves. Now, however, you are stuck between those ideas and the growing threat to Minnesota's Boundary Waters Canoe Area (BWCA) from acid rain produced by the proposed Atikokan coal-fired power plant. You have developed several suggestions for dealing with the problem:

1. Build the power plant with an extensive air quality monitoring system and the capacity to add pollution control "scrubber" devices. The plant is necessary to free North America from the domination of foreign oil. The modifications are needed to ensure that any acid rain problems will be quickly detected and resolved. You aren't so sure that acid rain is such a problem anyway. Booklets published by coal mining companies seem to say acid rain is just another big scare raised by environmentalists. You do want to learn more about it and think being a little cautious is the best route to take.

2. You are concerned about America's weakening power in the world. Although Canada is our close friend and neighbor, it shouldn't be allowed to poison our lakes and forests. Since the residents of the state of Minnesota face the risks from any acid rain caused by the Atikokan plant, they must have a major voice in the decision-making process.

Overall, you want to please the fearful residents of the BWCA region and continue to push for more use of coal in the production of energy. Undue fears of acid rain could anger the voters of Minnesota and hurt future chances of becoming energy self-sufficient. Compromise is the art of the politician, so you want to work as hard as possible to please the many people involved in this controversy.

S. Zorab

You are a 29-year-old Canadian government official concerned with "federal" matters--those issues that affect more than a single province in Canada. A lifelong resident of Canada, you have loose connections with John Fraser, a Minister of the Environment. Your position on the Atikokan coal-fired power plant issue reflects many of his opinions. You believe that the proposed power plant should be built with a plan to use "clean" or low-sulphur-content coal to minimize any risks from acid rain, an extensive air quality monitoring system to watch for dangerous acid rain signs, and the capacity to add pollution control "scrubbers" if needed. In addition, all should recognize that Canada must make the decision without undue pressure from the United States.

The proposed power plant at Atikokan is one more part of an efficient energy-producing network for Canada. The need for energy should not, however, overshadow vital environmental concerns. Acid rain is one such concern. Unlike dirty lakes and brown air, acid rain is nearly invisible and its effects are often confined to remote wilderness areas. Thus, our energy needs must be balanced with an understanding of the potential risks related to acid rain.

Your position on the Atikokan controversy meets this necessary balance. "Clean" or low-sulphur coal will allow the power plant to produce electricity with low SO_2 emissions. A monitoring system for acid rain will be economical and let scientists know if there is a problem before 15-20 percent of the forests are gone or many lakes have become fishless. Early warning allows risks to be analyzed in advance, rather than forcing us to figure out how to cure an environmental tragedy after it has occurred. "Scrubber" capacity costs almost nothing when the plant is being built, yet means that if acid rain becomes a problem, an economical solution will be available.

There are no "Mr. Cleans" in this whole acid rain/energy crisis debate. The United States and Canada must work together to prevent acid rain. Your solution to the Atikokan controversy meets Canada's needs and responsibilities and will also satisfy United States residents who worry about environmental damage coming from Canada.

T. Polachek

As a 33-year-old official of the Minnesota Pollution Control Agency (MPCA), you enforce air quality standards for the state of Minnesota. You and your new spouse live in St. Paul, but have a summer home near the Boundary Waters Canoe Area (BWCA). Thus, you have both official and personal opinions on the proposed coal-fired power plant in Atikokan. The MPCA's position is that if the plant is built, it should be built with 90-percent effective pollution control "scrubbers" and a good air quality monitoring system. You personally feel good about this position and will work hard to defend it. After all, your summers are spent near the endangered BWCA.

State air quality standards for industry set limits on the amount of pollution that can be added to the air each day. When this limit is reached, you must order manufacturing plants to close until the air quality is again acceptable. Such closings cut into employee wages and production schedules, resulting in economic loss. If Canada adds another air pollution source, the Atikokan power plant, more pollution will come into the state. If the pollution limit is reached, you certainly can't order the Atikokan plant to shut down. Thus, you would have to close a Minnesota company. The MPCA would have no control at all over pollution and acid-rain-causing emissions from the Atikokan plant.

The solution is to install 90-percent efficient "scrubbers" to remove the acid-rain-causing SO_2 gas from the smoke. The very small amount of pollution that would then enter Minnesota would not threaten the closing of local manufacturing plants. At the same time, the BWCA would be effectively protected from lethal acid rain. These are important benefits compared to the cost of adding the scrubber devices. In fact, the cost sounds large in a lump sum but really isn't that great when averaged over the lifetime of the plant. Finally, an air quality monitoring system will ensure that the "scrubbers" are working and acid rain is not becoming a hazard.

Robin Michelson

You are a 37-year-old miner who has lived your entire life in the Atikokan area. You went to the local high school and married your childhood sweetheart 15 years ago. With three growing children, you are worried about the future of your hometown. You favor building the proposed power plant without delay and without expensive additions.

A major reason for favoring this position is economic. Historically, the region around Atikokan has depended on mining and processing minerals. Now, however, the two major mining companies--Steep Rock Iron Mines and Caland Ore Company--are phasing out their Atikokan operations. The area needs the jobs that the proposed power plant would supply. In fact, the report prepared by Ontario Hydro said that there could be as many as 1100 construction jobs by 1982, when the mining companies will probably be long gone. The same report said that this wouldn't cause stress on educational, hospital, or recreational facilities in the area. To you that sounds pretty reassuring as you see your own job in the mines disappearing.

You favor building the plant for another reason. The oil situation has really driven utility rates sky-high. A coal-fired plant, using Canadian coal, will reduce dependence on foreign oil and lower, or at least stabilize, electricity rates. Expensive pollution control devices, "scrubbers," to remove possibly harmful gases are unnecessary because Ontario Hydro plans to burn low-sulphur coal. You read that money has been spent designing the plant to burn this cleaner coal instead of needing "scrubbers." You believe this is a crucial point.

In sum, you believe that building the plant means more money to the Canadian mining economy, jobs for Atikokan, and lower (at least more stable) electricity rates.

J. McHenry

At the age of 40, you are deeply concerned about energy and the future of the United States. As a former businessperson, you know about costs and benefits and you honestly believe that you are thinking about what is best for your country. You have been sent to this hearing by your department head. The position you favor is one of building the plant as designed and without extra pollution control devices.

To you, the facts are clear: the United States must constantly work to avoid another energy crisis. It needs all the help it can get, especially from friendly countries like Canada. The Atikokan plant will, either directly or indirectly, allow Ontario Hydro to continue exporting electricity to the United States. This obvious benefit will help the United States continue to reduce its dependence on oil imports.

Many say that a "cost" of the proposed power plant is the acid precipitation it might cause. You believe this problem has been exaggerated. Research by several agencies has not proven that acid rain is the environmental threat that many fear. The Atikokan plant will add to the amount of sulphate in the air, but not enough to cause a catastrophe. The addition, according to the Acres Report, would only be about 11 percent; this is not enough to cause delays or added expenses on an important source of electrical power.

As a matter of fact, you see a funny twist in this whole debate. A big stink is being made over the possible small contribution to acid precipitation from Atikokan's proposed plant while the United States is responsible for 80 percent of the sulphate going into Canada. Perhaps we should first clean our own house!

Mary Vellum

At the relatively young age of 29, you are a senior public relations official with Ontario Hydro. You hope to rise in the Ontario Hydro organization, eventually becoming a member of the Board of Directors. You and your new husband live in Toronto, and you have only been to Atikokan once. The Atikokan situation could really advance your career; thus you are putting a great deal of enthusiasm into your work on the project. You think that the Atikokan plant is needed and that all of the shouting about acid precipitation is "much ado about nothing."

Ontario Hydro doesn't make snap decisions when building power plants. Nearly ten years of planning went into the selection of the Atikokan site. Changing sites now would be unrealistic if the power needs of the region are to be met. Studies show that power demand will continue to increase in the western sector of Ontario Hydro's power network. The proposed Atikokan plant is a vital element in meeting future demand.

You are angry about the issue of potential acid precipitation. Ontario Hydro has voluntarily done an environmental assessment and found no major environmental hazards. In fact, the proposed plant will meet Canadian air quality standards. The potential for severe damage to the Boundary Waters Canoe Area (BWCA) has been extremely overstated. The Acres Report found little potential damage to the BWCA. Even the U.S. Environmental Protection Agency's own scientist, Gary Glass, predicted that only 10 percent of the Atikokan emissions would go to the BWCA.

It's clear to you: the power from Atikokan is necessary, pollution control devices are unnecessary and extremely expensive, and acid precipitation is an overstated problem. Let's build the proposed plant as designed and get on with supplying needed power to Canadian society.

Tom Krieger

Over the past five years you have learned a great deal about acid precipitation, becoming one of a handful of experts in the area. You are 35 years old and have worked since college graduation as a scientist in the U.S. Environmental Protection Agency (EPA) laboratory in Duluth, Minnesota. Although you live in a city, your family enjoys hiking and many vacations have been spent in or near the Boundary Waters Canoe Area (BWCA). Thus, you look at the controversy over Atikokan from both a personal and scientific viewpoint. After much thought, you have decided that the proposed power plant can be built without pollution control devices such as "scrubbers" and that the plant won't seriously increase acid precipitation in the BWCA.

Yes, the lakes in the BWCA are susceptible to increased "loading" or additions of acid rain. Thus, problems could occur _if_ a great deal of acidity enters the BWCA. However, that just doesn't seem likely. The Atikokan plant isn't large enough or so poorly located as to create that much acid rain. A study you saw mentioned that at worst only 3-5 percent of the lakes would "die" from acid rain in 20 years. You aren't happy about this, but as a scientist you recognize that it would be a relatively small cost for the benefits of more electricity and economic growth.

In addition, both the Acres Report and the environmental assessment by Ontario Hydro admit increased acid precipitation, but not nearly enough to severely damage the BWCA. In fact, according to your reading of the reports, the emissions would easily meet the strict Class I environmental protection laws for the BWCA. For good or ill, the data just doesn't support halting construction of the plant or the added expense and disposal problems of the "scrubbers" that would remove the SO_2 from the smokestack. "Scrubbers" aren't cheap and create another pollution problem of dumping the used limestone that chemically removes sulphur from the smoke. Acid rain is a problem, but not a severe one here.

Role Card RDB-21

K. Sprenger

Born 48 years ago in a small village outside Toronto, you have lived your entire life in Canada. Your spouse, three teenage daughters, and you now live in Toronto, Ontario, where you are a government official in the Ministry of the Environment. Though not a scientist, you have a good grasp of science and how government must work to make science beneficial to society. You are interested in this controversy because local, national, and international questions of science and public policy are being debated. As a representative of the Canadian federal government, you believe strongly that Ontario Hydro should build the proposed plant at Atikokan and should not be required to install the so-called "scrubber" pollution control devices.

Your somewhat general anger at the United States is one reason for your position. According to statements by Robert B. Taylor of Ontario Hydro, Canada receives 80 percent of its acid-rain-causing gases from the United States. It thus takes more than a little nerve for U.S. officials to want to stop one Canadian power plant that would only add 0.1 percent to the total SO_2 emissions in a 1500-kilometer circle around the BWCA. The United States should "clean up its own house" before blaming their acid rain situation on Canada. This argument is crucial to your position, and you have stressed it in many hearings.

Secondly, even if some lakes or forest regions in the Boundary Waters Canoe Area (BWCA) and the other parks are damaged by acid rain, only the very few people who use those areas will be affected. It isn't as though the Atikokan plant will destroy acres of crop land or hurt tens of thousands of people. In addition, there will be no economic loss to logging since no logging is allowed in the BWCA. No food sources, other than perhaps a few sport fish, will be lost to either Canada or the United States. Overall, acid rain from the Atikokan power plant won't cause that much loss, yet the plant will provide needed electricity.

In conclusion, you don't underestimate the potential hazards of acid rain elsewhere. It's just that it isn't a major problem in this case. Thus, the plant should be promptly built and built without expensive "scrubber" pollution control devices. Anything that increases the cost of the plant will only make electricity rates that much higher. Consumers don't deserve to bear that cost when acid rain, if it occurred, wouldn't damage much.

Susie Loeb

Married at age 16, you are now a 32-year-old wife and mother living in Atikokan. You have a very strong sense of self-confidence and fair play. This whole power plant controversy really burns you up and you let people know. You want the plant built, right now, and without those "scrubber" pollution control devices. You don't have to be a fancy scientist to understand why the plant is needed.

Your husband works in a mine that is due to close soon. With the mine closing go his job and income. The power plant would provide construction work and perhaps even long-term employment. You love Atikokan and don't want to be forced to move because of the loss of your husband's job. Many other miners and their spouses agree wholeheartedly on this point.

On the question of acid rain, you have several strong feelings. First, even the scientists disagree on its potential impact. Thus, build the plant, do a study, and then worry abut it. If, by chance, acid rain is a real problem, known solutions to it can be used. Limestone can be added to lakes to neutralize the acid and fish that can live in more acidic water can be bred. Frankly, your husband's livelihood is more important than a few fish; there will always be plenty of fish in other lakes.

On the question of adding "scrubbers" to remove the acid-rain-causing sulphur gas, you also have opinions. You read that "scrubbers" would cost millions, thus adding to already expensive electricity rates. "Scrubbers" also create a solid waste disposal problem--the used material has to be disposed of somewhere. Would this be trading one environmental problem for another?

No, the plant is necessary to the local economy and should be built without the expensive pollution control devices. After all, they already scaled the plant down by 50 percent--a decision that probably will affect your husband's livelihood. Saving the life you know depends on going ahead with building the plan. A final point--why don't those busybody environmentalists stay home and quit upsetting everyone else's lives? Until they arrived, no one seemed too upset about this issue.

P. Schmidt

Dynamic, hard-driving, and deeply confident in your views of the world, you are a 39-year-old representative of Flatiron Machinery Corporation, a major manufacturer of coal mining equipment. You sell and promote huge earth-moving machines that are used in the United States, Canada, and around the world. Obviously, your livelihood is tied to the mining and use of coal, especially for producing electrical energy. You live in Milwaukee, Wisconsin, but your company has sent you to give testimony in the Atikokan generating plant controversy. Both you and other company officials feel it crucial to "nip in the bud" the movement against using coal for generating electricity. Thus, your position is that the Atikokan plant should be built--as soon as possible and without costly and unnecessary pollution control devices.

You are very upset about the subject of acid rain. The data you have seen, especially in a speech by a Bucyrus-Erie official, seems to indicate that acid rain is actually declining! According to this document, even the (EPA) scientists admit that much of their data is only 10-20 percent accurate. As a matter of fact, if we're worried about acid rain, we'd better learn to put pollution control devices on volcanoes because they pollute more than humans.

You are also more than a bit "peeved" with the environmentalists and their arguments. You are convinced that their goals are noble, but their methods are at best a wonderful example of the use of overstatement. In fact, in the speech mentioned above, one environmentalist was quoted as saying "We tend to overstate" when the claim of increased pollution in the Grand Canyon was found to be in error.

Our nation, Canada, and other nations need to exploit their coal resources to provide needed electricity--a point you must really stress. Coal can be burned cleanly, cheaply, and without causing suspect problems like acid rain. Your future livelihood and the future of the nation depend on it.

Pierre Broussard

At the age of 67, you're a retired corporate attorney living in Montreal. You have served on the IRC for 15 years. As an attorney, you represented many major Canadian corporations, including a power company in British Columbia. You respect the ideas and judgments of businessmen and believe that a strong Canada needs strong industry. The position you hold on the IRC is one you are proud of and take very seriously. Although a Canadian, you know that the best goal of the IRC is to make both the United States and Canada work together in harmony. You will work hard to make this goal a reality.

On the problem of whether to build a coal-fired power plant at Atikokan, you have several opinions and several questions. You do respect business, but also enjoy a day in the woods hiking or fishing. Your grandchildren often camp in the Boundary Waters Canoe Area (BWCA). As a wealthy man, you know that just because something costs "millions" doesn't meant that it is all that expensive in the long run.

You want lots more information, but the following questions are of greatest importance to you:

--What is the cost of the various options, including extensive air quality monitoring, "scrubbers," and "scrubber" capacity built into the plant?

--What impact would these options have on electricity rates of Ontario Hydro customers?

--Might there actually be benefits from acid precipitation?

C. Codianno

A 47-year-old top environmental lawyer, you make your home in Toronto, Ontario. You also helped write the highly successful United States-Canada Great Lakes Treaty covering water quality in United States-Canadian waters. As an IRC member for the past five years, you are optimistic that the "Treaty on Air Quality" can be successfully followed in the Atikokan controversy.

You got into environmental law because of your love for wildlife, clean air, unspoiled wilderness, and nature in general. Although you were originally very radical, you have mellowed a little and now realize that not all of the wilderness can be preserved. Somehow, a balance between nature and the needs of society must be created. You also realize that, unfortunately, not all controversies lend themselves to balanced solutions. You are "pro-environment," but realistic, too.

You have not really made up your mind on whether a coal-fired power plant should be built at Atikokan. Clear, factual, and convincing arguments could sway you in any direction. In addition, answers to the following questions would be extremely helpful:

--Will the power plant meet U.S. Environmental Protection Agency and Canadian Ministry of the Environment air quality standards for the region?

--Is the power plant necessary for the generation of electricity?

--What are the opinions of the people who know the region best, the people of Atikokan and northern Minnesota?

A. Griffith

You hail from the great state of Georgia, which you represented for ten terms in Congress. At age 51, you are once again a wealthy landowner and farmer. You were appointed to the IRC two years ago as a political reward, but you enjoy and value your position as a representative of the United States. An avid outdoorsperson, you have a deep fondness for wilderness areas. You also believe deeply in using industry to build a nation's economy. As a Representative in Congress and as a private citizen, you have always been loudly pro-American. However, your brief experience on the IRC has shown the importance of the United States and Canada working side by side to maintain a strong, democratic continent. Clearly, you bring many values to the IRC hearing on the proposed coal-fired power plant at Atikokan.

In deciding the Atikokan controversy you feel several issues must be addressed. Strong, clear, and factual arguments will be needed before a solution can be reached. You insist that all speakers base their arguments on fact, not opinion.

The key questions you have are:

--If the power plant is built, how much damage will there be in the Boundary Waters Canoe Area from acid precipitation?

--What would the impact of acid precipitation in the area be on fish production? lumber yield? crops? humans?

--Where will the emissions from the proposed plant fall, and is this the only source of acid rain that we must worry about in the area?

R. Zolot

You are a 48-year-old attorney who lives in New Hampshire. You have served on the IRC for seven years. Previously, you were staff council to the Nuclear Regulatory Commission (NRC) so you feel very comfortable handling complex technological issues. One reason for this is that your undergraduate degree was in engineering. While on the NRC staff, you became sensitive to two major concerns that are important in the Atikokan controversy. The first is the world energy crisis. You are worried about foreign control of oil supplies and believe that coal, nuclear fusion, and conservation are crucial for the future energy independence of the United States and Canada. The second is a much greater appreciation for the environmental damage that can come from too-rapid development of new technology or the production of energy. Radiation and acid precipitation are two real dangers that we just don't know enough about. These two issues are important in your role as an IRC member.

On the question of whether to build a coal-fired power plant, you are undecided. You do believe strongly in the need for "neighbors" to cooperate, but not so strongly as to accept a compromise that would be harmful to society in general.

You will need clear answers to the following questions to help make up your mind:

--What would be the impacts of the Atikokan plant on human health, the resort industry, and sport fishing?

--Where else have the impacts of acid rain been reported and how serious is the damage?

--In light of the energy crisis and our energy policy, is the Atikokan plant necessary?

Harriet Johnstar

You are the 74-year-old retired publisher of a major New York newspaper started by your late husband. You took over the paper when he died nearly 20 years ago. Your home is still New York, although you travel widely and have a summer home in the New England mountains. Always a liberal, you have long supported strong environmental regulations. Recently, you read an extensive story on the harm that acid rain is supposed to be causing in New England, from fishless lakes to lowered lumber yields. The article mentioned that the source of this new pollution was probably coal power plants in the Ohio River Valley, almost 1000 miles away. The potential destruction of your lovely summer home area bothers you greatly.

As a member of the IRC for the past eight years, you have rightly earned a reputation as someone who listens carefully to arguments and never pre-judges a controversy. You will have to work hard to objectively listen to the debate over the proposed coal-fired power plant at Atikokan because of your concerns for acid rain in New England. Just because it is a problem there doesn't mean it will be a major problem in the Boundary Waters Canoe Area (BWCA). Insist on facts to support any arguments presented during the hearing.

In order to help you judge this case, you will need good answers to these and other questions:

--If acid rain does cause lakes to become more acid, can the damage be cured?

--Could coal with a lower sulphur content be burned and what would it cost?

Role Card RDB-29

The Honorable P. Cornwall

Once the ambassador from Canada to Australia, you are now a 46-year-old career diplomat living in British Columbia, Canada. You were appointed to the IRC several years ago because of your excellent negotiating skills. You are very good at taking in information, talking to all parties, and then suggesting a solution that makes everyone contented. However, you also know that some problems just can't be solved by compromise and that one side or another is going to lose what it is fighting for. If necessary, based on the facts, you are ready to make such a decision.

Because you have studied international relations, you know how important United States-Canadian relations are to a peaceful continent and world. As an IRC member, you do not want to put stress on the friendly relationship between the two countries. On the other hand, you know that neither country can legally force the other to do anything except through the IRC. This fact makes your ultimate decision all the more important.

On the question of whether to build a coal-fired power plant at Atikokan, Ontario, you are still undecided. You need, and will insist upon, clear and factual answers to many questions during the hearing. Several of the more important are:

--Which of the various options for controlling acid rain is most economical while still being effective?

--What pollution problems are there if "scrubbers" are used to control SO_2 emissions?

--Who sends more acid-rain-causing SO_2 gas to the other country, the United States or Canada?

M. Hernandez

You are 56 years old and are the honorary chairperson of the International Regulatory Commission (IRC), a body established to enforce clean air standards between the United States and Canada. Your home is Mexico, where you have served as a high-level judge. Both the United States and Canada approved your nomination as head of the IRC.

Your concerns are a bit broader than those of others on the IRC. Since you are neither a citizen of Canada nor the United States, you are more concerned about maintaining good relations between these major democratic nations. As a matter of fact, you hope that the IRC can be a model for solving problems between the United States and Mexico.

As chairperson of the IRC, you will run the public hearing regarding building a coal-fired power plant at Atikokan, Ontario. If the IRC decides the plant should be built, you must also consider whether to include some form or forms, of pollution control to prevent acid rain. The issue of acid rain is a major one and should be carefully discussed. Remind speakers to use facts and to present arguments clearly. Encourage your fellow IRC members to listen carefully and with open minds. You, too, must follow the arguments closely. In fact, you have several concerns that need to be addressed. They include:

--Is this plant necessary?

--How do the Native Americans in the area feel about the proposed power plant?

--During an energy crisis, must people in the United States, Canada, and elsewhere accept lower air quality and problems like acid rain?

--Realistically, now much harm could the Atikokan plant cause in both the long and short run?

ACTIVITY 4
30,000 BARRELS OF GOO: TOXIC WASTE CONTROLS

OVERVIEW:

"30,000 Barrels of Goo" involves the debate over the disposal of toxic waste products from the manufacture of chemicals. The simulation is based on an actual case of a company which incinerates hazardous chemical wastes and the controversy involved in the company's continued operation.

Students are assigned roles representing members of the state Commission on Environmental Quality, local and community government officials, company representatives, and other interested individuals. The students participate in a simulated Commission on Environmental Quality (CEQ) board hearing to argue whether the plant operated by the fictional Industrial Disposal Systems, Inc. (IDSI) in the state of Quincy should be allowed to continue operating, given the potential health hazards of the industry's waste products. The CEQ considers three basic alternatives:

--Close the IDSI plant

--Let IDSI decide what to do about the plant

--Negotiate an agreement

Students are divided into groups representing each of the three positions on this issue and a decision-making group, the previously mentioned CEQ board. Through several days of research, the groups compile evidence to support their respective positions.

The research component of this simulation varies slightly from others in this publication. In "30,000 Barrels of Goo," students are provided with an extensive data packet containing fictional city and state ordinances related to toxic waste disposal and a series of correspondences between the primary parties in this dispute: the City of Wellington, the State of Quincy, the Commission on Environmental Quality, the Industrial Disposal Systems, Inc., lawyers for each side, and concerned citizens. Students will draw most of the information they need to support their various positions from the data cards.

Library research may supplement data card research. Through library research, students can compile additional and current information about toxic waste hazards, toxic waste disposal and disposal regulation in the United States, and examples of other toxic waste controversies and their solutions. Such evidence compiled through library research will strengthen and enhance student arguments.

The culminating exercise for this activity is a CEQ board hearing, during which the three advocacy groups present their positions, supported by data they have collected, to the board. Through analysis and questioning, the CEQ board must reach a majority decision on the issue.

A discussion analyzing the different viewpoints and the decision-making and risk-management processes concludes the activity.

OBJECTIVES:

After participating in "30,000 Barrels of Goo," students will be better able to:

1. Explain and discuss the social, political, and economic factors that influence decisions made on public policy issues of science and technology.

2. Identify and describe the central conflict involved in a problem requiring social action and decision making.

3. Clearly state the interests and values involved in a problem situation.

4. Systematically analyze the risks in a problem situation and consider ways to minimize those risks. For example: What are the potential negative effects (risks)? Of what magnitude are the potential effects? What is the probability of the occurrence of these effects?

5. Identify or state alternative solutions to a problem situation.

6. Identify and analyze the probable consequences of particular courses of action.

GRADE LEVEL: 9-12

TIME: Approximately 7 class periods. The "Activity Timeline," Handout 4b, provides a schedule of activities.

MATERIALS: 30 role cards

Handouts. Reproduce as indicated.

4a: Background Notes: Toxic Waste Disposal (1 per class member)
4b: Barrels of Goo Activity Timeline (Reproduce 1 per group)
4c: Instructions to Group Leaders (1 per group)
4d: Risk Assessment (1 per group)
4e: Press Release (1 for CEQ Board group)
4f: Barrels of Goo Group Worksheet (1 per advocacy group)
4g: Commission on Environmental Quality Board Group Worksheet (1 for CEQ board group)
4h: Suggested Resources on Industrial Waste (1 per class member)
4i: How to Run a Commission on Environmental Quality Board Hearing (1 per CEQ board member)

29 Data Cards. Reproduce 1 class set or a set for each group.

237

PROCEDURE:

Before beginning this activity, teachers and students should read Handout 4a, "Background Notes," which contains general information on the chemical waste controversy and the specific arguments on closing the chemical plant. This reading will be critical in providing you and your students the background needed to participate fully in the activity. You might assign the "Notes" as a homework reading the day before the simulation is to begin.

Day 1: Introduction

A. Introduce the activity by conducting a brief discussion of the chemical waste problem as outlined in the "Background Notes."

B. Highlight the specifics of the role-play situation and introduce students to the decision-making steps outlined in the "Conceptual Basis for CREST" (pp. 3-7).

C. Assign each student a role and distribute role cards.* Names with initials may be played by males or females. Divide the class into the following four groups. Allow 10-15 minutes for participants to read their role cards and introduce themselves to their groups.

Negotiate an Agreement

R.M. Wodnik
A.A. Stavros
W.C. Radsek
John Dwyer
Ronald Zawarski
Joyce Ruiz
R.B. Hosakawa
C.A. Burich

Let IDSI Decide

Barton Stone
W.E. Melek
K.V. Ridley
D.P. Sorbo
Steven Pappas
N.R. Nolan
Doreen Van Duesen

Close the IDSI

J.A. Kircher
Maria Alifano
Patricia Yung
Kevin Allen
A.M. Willette
Arthur O'Reilly
J.D. Steiger
H.D. Ingvold

Commission on Environmental Quality Board

Bill Mahoney
Ramon Martinez
Wilma Urek
Edna Carlson
J.T. Petrocelli
Sarah Kronowski
C.F. Washington

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*If the class has fewer than 30 students, the same relative size should be maintained for each group. The unused role cards should be added to the data compiled for that group since the information in them is important for the group to consider. For larger classes, students can work in pairs on single roles.

D. Distribute to each group a copy of Handout 4b, "Activity Timeline" and quickly review its contents. Identify one or two leaders for each group. They will be responsible for ensuring that the group attends to its tasks. Each group leader should receive a copy of Handout 4c, "Instructions to Group Leaders."

E. The initial group task is to begin to assess the risks related to chemical waste disposal. Students should use information from the group members' role cards. The questions on Handout 4d, "Risk Assessment," should be used to guide discussion in each group.

F. (Optional) As homework, students should become completely comfortable with the information in their role cards. Teachers might assign students a re-reading of the background notes from the perspective of their role play.

Day 2: Preliminary Hearing and Intragroup Discussions

A. As a class, take 5 minutes to review the information compiled yesterday on Handout 4d, "Risk Assessment."

B. Using "Risk Assessment" as a guide, the CEQ board conducts a brief (approximately 15 minutes) preliminary class-wide hearing focused on the following major questions:

--What are the potential negative effects of improperly disposed chemical waste?

--How extensive will these effects be?

--How likely is it that these effects will occur?

Be sure the CEQ board members understand that at this point everyone is operating with very little data. There will be some disagreement about the potential risks, especially the magnitude and the probability of their occurrence. In trying to assess the potential risks, the examiners might focus on the worst that could happen and identify the various positions on how likely it is that it will happen. More extensive discussion of the risks will take place during the activity's public hearing on Day 6.

C. Following the preliminary hearing, the CEQ board prepares a news release on Handout 4e, "Press Release." This news release should be reproduced and distributed to the other groups.

After completing the news release, the CEQ Board should begin to consider the alternative courses of action provided on Handout 4g, the "CEQ Board Group Worksheet." The group should identify important questions related to each alternative for use in guiding the discussion during the public hearing.

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While the CEQ group is preparing the news release, the three advocacy groups should complete Parts I & II of Handout 4f, "Barrels of Goo Group Worksheet." This is the first step in preparation for making presentations on their positions during the CEQ Board hearing. As the groups begin work on the worksheet, they should identify their proposed courses of action and discuss reasons for their positions. The reasons should be listed in the left-hand column of the worksheet. Group leaders should see that each group member identifies at least one reason for that group's position. Careful reading of the role cards will facilitate this process.

The following are some of the key arguments that can be made by each of the three advocacy groups in "30,000 Barrels of Goo." Students can find many of these arguments set forth in the "Background Notes" and in their role cards. During research on Days 3 and 4, groups will seek specific supporting data for the arguments they choose.

Close the Plant

--There are immediate health hazards created by the thick, noxious smoke from the incinerator.

--The residents of Warrington have complained repeatedly about the smoke from the plant.

--No one really knows the extent of the hazards created by IDSI since there is no way of being certain about what is contained in all the barrels stored on the plant site.

--There is a fire hazard at the plant, and there has already been one fire there.

--The tax money that IDSI pays is not enough to make up for the risks it creates for the people of Warrington.

--The company's past performance indicates that it cannot be trusted; it currently has an agreement with the county and is not abiding by the terms of that agreement.

--IDSI should never have accepted materials for disposal which it was unable to dispose of properly.

--The state should never have issued operating permits to IDSI.

--IDSI has clearly violated state laws.

--It is not clear how an agreement with IDSI would be monitored. Someone must watch them all the time, but nobody has accepted that responsibility.

--The state cannot be expected to do an adequate job of monitoring IDSI; they are not doing a good job of watching the current problem.

--Either the company or the state or both should pay for the cleanup after the plant is closed.

--The plant creates unsightly and unsanitary conditions in the area.

--IDSI is creating a "bad image" for Warrington. Other "clean" industries will be hard to attract if IDSI continues to operate.

--IDSI is not abiding by the operating permits issued by the state.

Let IDSI Operate As It Chooses

--All the stipulations in the agreement will cost money. To get this money IDSI will have to raise its prices. Some companies may then choose cheaper--and much more hazardous--disposal alternatives such as "midnight dumping."

--The health hazard arguments of opponents to IDSI is not supported by facts; indeed, there has been no evidence of health effects among IDSI employees.

--Many of the regulations are unreasonable, and abiding by them takes time and money. IDSI should be allowed to use its time and money to do the best job of disposing of wastes.

--IDSI provides an important, even necessary, service for the state; the CEQ should help it to provide that service. Currently, the CEQ just gets in the way.

--IDSI is being called upon to please everyone--the state, the county, the city. All these different jurisdictions have different requirements, and it is too difficult for IDSI to meet all these requirements.

--IDSI is faced with a clear case of over-regulation.

--If the plant is closed, there will be no way of knowing where or how these hazardous wastes are being disposed of.

--Closing the plant will not eliminate all the hazards; the barrels will remain on the site and that may result in serious groundwater contamination. If the plant is allowed to continue its operation, IDSI would eventually get rid of the barrels.

--IDSI will become more effective in disposing of these wastes since it is to their economic benefit to do so; the more effective they are, the higher will be their profits.

--If the plant is forced to close, many people will lose their jobs.

--The company is relatively small and has limited financial assets; this will make it difficult to meet the financial obligations of a stipulation agreement. It is necessary for the company to accept a greater volume of waste to get the money to pay for new equipment.

--The company has made good faith efforts to comply with government regulations, but the regulations are not always clear; often they are confusing or contradictory.

--The company should be allowed to continue its operation since incineration is the "cleanest" means of disposing of hazardous wastes.

Negotiate a Stipulation Agreement

--If the company were forced to use proper equipment and techniques, there would be no problem.

--Closing the plant will not eliminate the hazards.

--The long-term problems created by the barrels, ash, and sludge are potentially more hazardous than the smoke from the incinerator. IDSI must be made to deal properly with these long-term problems.

--The agreement can be used to force IDSI to deal with both the short-term and long-term problems.

--The agreement can specify both the steps to be taken and a means of insuring that they are taken.

--The greatest potential health hazard from IDSI is the contamination of drinking water by chemicals seeping into the ground. The agreement can specify ways of preventing this from happening.

--There is no other facility in the state for disposing of hazardous chemicals. IDSI should be kept open under strict controls; otherwise, companies may dispose of hazardous chemicals in totally unacceptable ways--for example, "midnight dumping."

--Negotiating a stipulation agreement will be less costly and time consuming than taking court action to close IDSI.

Day 3-4: Research

A. At the beginning of Day 3, each group should receive copies of all 29 data cards. Alternatively, a single class set may be provided in a central location. The information in these cards will provide most of the evidence to support the group's position or contradict the position of another group. The data in these cards may be used in a variety of ways. Some are clearly supportive of only one position. Other data may be interpreted to support different positions. Still other data may be irrelevant. Furthermore, data may be inadequate to support a particular position or may be biased in content or presentation. Students participating in this activity should become better able to recognize these distinctions.

A brief summary of data card contents is provided here for your information.

Data Card Number	Title
1	Quincy air pollution control regulations
2	Quincy water pollution control regulations
3	Permits for IDSI construction and operation
4	Letter from E.W. Melek and Associates, Attorneys
5	Response to Melek from Bear Paw County
6	Request for license from IDSI
7	IDSI proposed improvements in waste disposal
8	Bear Paw County memo on daily inspections of IDSI
9	Bear Paw County memo on daily inspections of IDSI
10	Bear Paw County memo on daily inspections of IDSI
11	Bear Paw County memo on daily inspections of IDSI
12	Cease and desist order to IDSI from City of Warrington
13	Bear Paw County memo on daily inspections of IDSI
14	Customer service letter from IDSI
15	Letter from Bear Paw County to IDSI
16	Bear Paw County memo re toxicity of ground water around IDSI
17	Letter from concerned corporation to IDSI
18	Response to 15
19-21	Monthly incoming and disposal report of IDSI
22	Citizen complaints re IDSI
23	City of Warrington soil and groundwater monitoring report
24	Estimated cost for clean-up at IDSI
25	Estimated cost for repairs and modidications at IDSI to meet state requirements
26	Diagram of IDSI plant
27	Memo from IDSI to plant managers
28	Customer service letter from IDSI
29	Stipulation agreement between CEQ and IDSI

B. Teachers may choose to confine the research component of this activity to investigation of the data cards. However, it is recommended that you complement data card research and analysis with a day of library research on Day 4. The data cards will provide evidence about this specific case while the library research will acquaint students with additional real cases in the toxic waste issue, recent legislation, and so on. Such information will strengthen their understanding of the issue and enhance their presentations at the simulated hearing on Day 6.

During the library research, assign each group to collect at least one piece of evidence per person. A list of suggested resources is provided in Handout 4h. Not all of these resources may be available to all schools and communities. Students should be encouraged to consult the local library as well as the school library, to contact local organizations, and to look for information on this topic relevant to their own state or region.

C. The CEQ board will use Part II of Handout 4g, "CEQ Board Group Worksheet," as a guide to its library research. Members must identify important questions for each alternative course of action, locate through the library or other sources information related to these questions, and record the references on the worksheet. This process will help them prepare for the CEQ board hearing. To question each of the groups after their presentations at the meeting, the examiners must have a clear understanding of all the information collected through research.

D. While the board is conducting its research, the three advocacy groups complete Handout 4f, "Barrels of Goo Group Worksheet" in preparation for the hearing. This will require them to find information to support the reasons they outlined on Day 2 for their positions.

Teachers should remind students that the quality of each group's presentation, and ultimately its influence on the final decision, will depend on how rigorously group members conduct their research, how carefully they select relevant data, and how clearly they communicate this information during the public hearing.

Day 5: Preparation for the CEQ Hearing

A. The three advocacy groups go through their group worksheet and finalize arguments for the hearing to take place on Day 6. Each group will discuss how its presentation will be made. They will each pick a spokesperson and three witnesses to present at the hearing on Day 6. The spokesperson for each group will prepare to present the main arguments and supporting information, and each witness will be responsible for adding some new perspective and information. The witnesses should not merely repeat the same points made by the spokesperson. Remaining group members will act as prompters during the hearing and thus should be confident of all evidence and procedure.

B. The CEQ board will spend this time studying Handout 4i, "How to Run a CEQ Board Hearing." The CEQ board should also review all evidence in the data packet in order to be able to respond to all groups during the hearing.

At the end of Day 5, each of the four groups should be fully prepared for the CEQ hearing.

Day 6: CEQ Hearing

A. The CEQ board conducts an open meeting according to the schedule which is outlined on Handout 4i, "How to Conduct a CEQ Board Hearing." The group advocating closing IDSI should make its presentation first. The spokesperson should briefly present the major arguments; three witnesses will present additional points. They should all refer to specific references when supporting their arguments. Following each presentation, the examiners should take several minutes to question the group to clarify its position. The pattern should be repeated for the let-the-IDSI-decide group and the negotiate-an-agreement group. During the meeting, the CEQ board members use the questions they identified on their worksheet to guide discussion. They should also ask each group for information on the costs and benefits of their proposed course of action. Part III of the "CEQ Board Group Worksheet" will be useful for this purpose.

B. After all three presentations have been made, an open question/answer and discussion session should be held.

C. When the discussion is completed, allow each group 2 minutes to plan a 1-minute final statement. Each group spokesperson presents the final statement to the hearing in the same order as the original arguments.

D. The CEQ board holds a brief (5 minutes) private discussion in which they reach a decision on the issue. The board then announces the chosen course of action to the other groups.

Day 7: Final Discussion (Debriefing)

This phase is crucial in helping students recognize what steps they have followed in the risk-management/decision-making process.

A. Each group should spend 5-10 minutes discussing how the CEQ board's decision will affect the group members and the community.

B. The teacher holds a brief class discussion to identify the various ways the decision will affect different individuals.

C. Next, the teacher should have the class turn its attention to some of the key issues in the case. The following questions can be used to help guide the discussion:

--What, in the final analysis, are the major benefits and disadvantages of allowing continued operation of the IDSI plant?

--Does chemical waste concern you or cause you to worry?

--Do you feel that a decision such as this one should be made as it was in our class? Should citizens have a strong voice in such policy issues?

--What data were most persuasive in this case? Explain. What data were least convincing?

--What are the value differences between such spokespeople as an environmentalist, a citizen concerned about drinking water, an IDSI executive, and a government environment scientist? To whom do you best relate? Explain.

--Can technology such as pollution devices ultimately solve all of the problems facing our society?

D. Finally, the class should consider carefully the decision-making and risk-management process, using the following questions:

--Did all groups recognize the same risks? Why or why not?

--Were there any risks on which everyone agreed? What evidence was used to identify these risks?

--Which risks were seen as most serious? Why? Which were seen as least serious? Why?

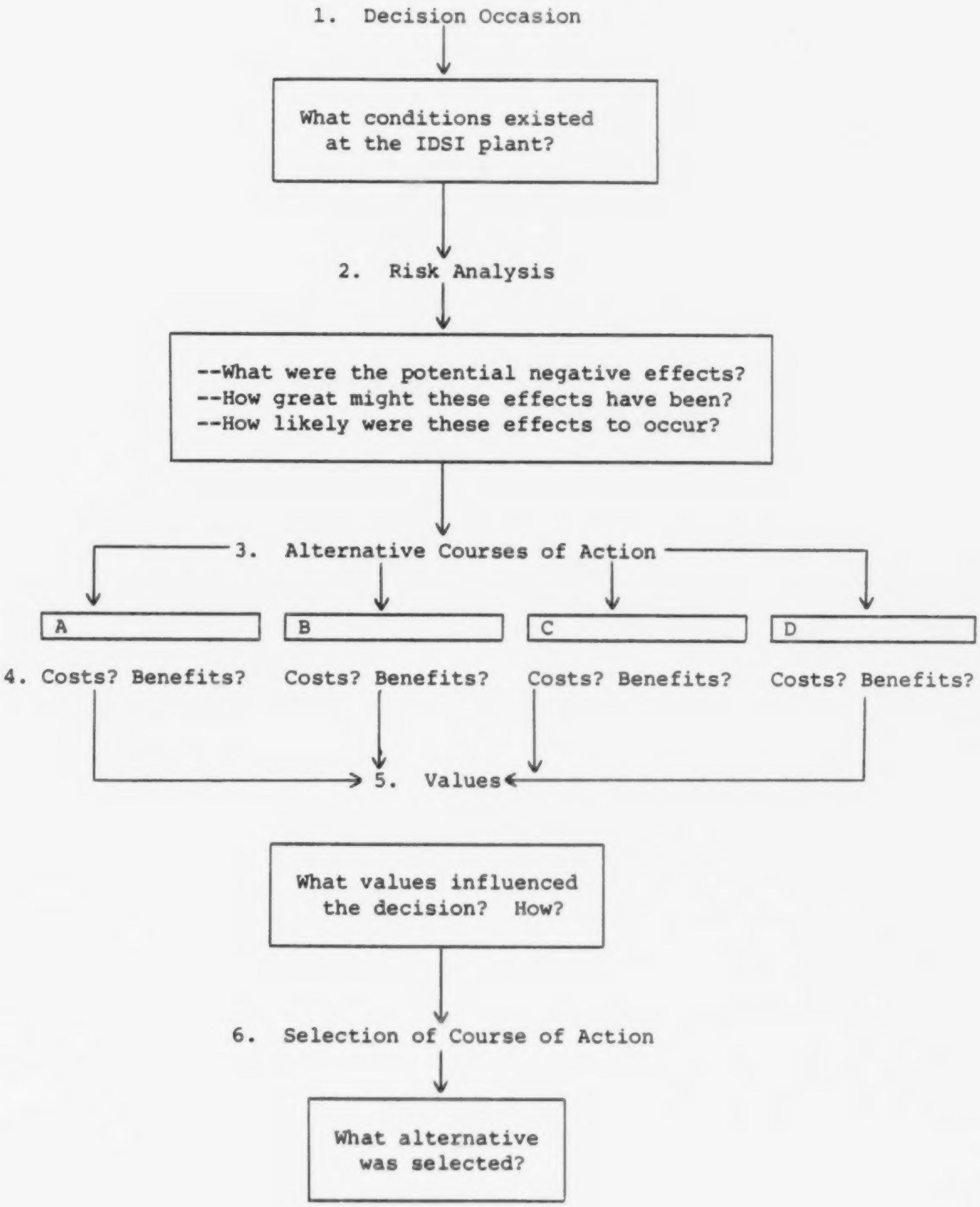
--Who (for example, residents, employees) faced the risks? Did they voluntarily face these risks?

--Do you think it is fair for businesses or government to create risks for people without their knowledge or approval? Why or why not?

--What values influenced the positions held by the different groups? How did these values affect the conflict over the IDSI case?

--What role did technology play in the toxic waste conflict? Did it help create the problem? Add to it? Help resolve it? Explain your answer.

E. Now, turn the students' attention to the decision-making process. Have them review the six decision-making steps followed in this activity. Then, use the framework below to review the process they followed in the case. As they answer the questions, you should fill in the framework on the chalkboard. This page may also be reproduced and assigned as homework at end of Day 6.


1. Decision Occasion
What conditions existed at the IDSI plant?
2. Risk Analysis
--What were the potential negative effects?
--How great might these effects have been?
--How likely were these effects to occur?
3. Alternative Courses of Action
A
B
C
D
4. Costs? Benefits?
Costs? Benefits?
Costs? Benefits?
Costs? Benefits?
5. Values
What values influenced the decision? How?
6. Selection of Course of Action
What alternative was selected?

Ask the students to match the six decision-making steps with the six parts of the framework above. The following is a brief description of how they should match up:

Decision Making	Risk Management Framework
Defining the Issue	1. Decision Occasion 2. Risk Analysis
Recognizing Interests and Values	5. Values
Identifying Alternatives	3. Alternative Courses of Action
Locating and Using Information	All
Probable Consequences	4. Costs and Benefits
Selecting Course of Action	6. Selection of Course of Action

HANDOUT 4a: BACKGROUND NOTES: TOXIC WASTE DISPOSAL

Finding safe, effective means of disposing of chemical wastes is one of this nation's most serious environmental problems. This fact has been recognized by a subcommittee of the United States House of Representatives. The House Commerce Subcommittee on Investigations reported that hazardous wastes pose "an imminent hazard to (humans) and the environment," and the "hazardous waste disposal problem cannot be overestimated."

The extent of the problem is illustrated by Environmental Protection Agency (EPA) estimates that 77.1 billion tons of hazardous waste are produced by the nation's industry each year. Our economy uses chemicals in the production of goods ranging from clothing to fertilizer. Synthetic fibers, plastics, paints, solvents, pharmaceuticals, and food preservatives are only a few of the important chemical products manufactured in the United States. Chemicals are so important to our economy that more than 5 percent of the nation's gross national product comes from chemical sales. These sales amount to over $100 billion each year. More than 30,000 chemical substances are employed by our economy, and a thousand new substances may be introduced each year. Chemical wastes will continue to be a significant by-product of our industry.

In the past, disposal of such waste has been marked by disregard for the environment. The House subcommittee found that only about 10 percent of each year's production of hazardous wastes are disposed of properly. A recent EPA study found that there are between 1,204 and 2,027 significant problem disposal sites throughout the country. House investigators visited many of these sites and found a repeated pattern of polluted water supplies, unexplained illnesses, excessive radiation levels, and other dangers. Known cancer-causing chemicals were found at many of the sites. Based on these observations, the subcommittee claimed that "industry has shown laxity, not infrequently to the point of criminal negligence, in soiling the land and adulterating the water with its toxins."

Cleaning up the existing waste disposal sites, many of which have been abandoned, will be extremely expensive, and no one is sure who will pay the bill. The EPA estimates that emergency treatment of these sites will cost between $2.9 and $4.9 billion. But these figures do not represent the cost of an ultimate remedy; that may cost from $21.1 to $35.5 billion.

Even these figures, however, do not tell the whole story because nobody is sure that they have found all the abandoned chemical waste disposal sites. Many of these sites have been covered with landfill and new buildings. Such sites may pose problems years after their abandonment. A housing development, including an elementary school, was, for example, built on top of a sealed chemical dump in Niagara Falls, New York. That dump had not been used for 25 years. But in 1978 chemicals from the dump began leaking out of the ground at the nearby Love Canal. Because of the health hazards over 230 families were forced to leave their homes permanently.

Other abandoned sites have posed similar problems. In Kentucky, 21,000 barrels of chemical waste were found rusting and leaking into an open shale rock area. Other sites are not this easy to find, and the chemicals leak unnoticed into the ground, eventually reaching groundwater and affecting drinking water supplies. However, one need not drink the water to be affected by such contamination. The chemicals enter the food-chain through plants, animals, and fish. Fish, for example, may come from waters into which benzene, toluene, chloroform, dioxin, PCB, or other hazardous materials have been dumped. Contact with these chemicals through continued eating, drinking, or breathing of contaminated substances may result in skin irritation, convulsions, high white cell counts, paralysis, liver tumors, stupor, leukemia, and death.

The PCBs probably illustrate the long-range dangers of chemical contamination better than any other contaminants. These are chemicals of the polychlorinated biphenyl family. These products were used widely in industry and released into the environment through dumping prior to the 1970s. PCBs have found their way into the Great Lakes and into human food supplies. PCBs have also been found in human bodies and even in the milk of nursing mothers.

For many years the disposal of chemical wastes went almost totally unregulated in many states. Louisiana was one state with few restrictions. On July 25, 1978, the need for regulation became clear. A 5,000-gallon truck driven by a 19-year-old man backed up to a dump site in Bayou Sorrel. The young man hooked up a hose and began dumping his cargo of chemical wastes. As the chemicals flowed into the dump, the driver died. He had inhaled six times the lethal dose of sulfide fumes.

More and more states are enacting legislation to control the disposal of toxic wastes, and two major pieces of legislation have been enacted into law by the U.S. Congress. The Toxic Substances Control Act, (TSCA) signed into law on October 11, 1976, authorized the Environmental Protection Agency to obtain production and test data from industry on selected chemical substances and mixtures, and to regulate the substances when needed. Chemicals used exclusively in pesticides, food, food additives, drugs, and cosmetics are exempted from the Act. TSCA is the major law regulating PCBs.

The Resource Conservation and Recovery Act (RCRA) was also passed in 1976. Subtitle C or RCRA provides for a program to manage hazardous waste from its generation to its ultimate disposal. Subtitle C calls for the establishment of national standards to assure consistency of hazardous waste management practices across state lines and the development of strong state hazardous waste management programs compatible with national regulations. RCRA also provides authority for the federal government to regulate the management of hazardous waste in a state if the state itself chooses not to do so.

The control and regulation of hazardous waste, then, may come from any level of government from municipality to the national level. These different levels do not always work in harmony, and problems of jurisdiction are very common.

The "30,000 Barrels of Goo" Role Play

The case of Industrial Disposal Systems, Inc. is based on an actual case, although all names, dates, and places have been fictionalized. The essential facts and the agency process, however, do accurately reflect reality. The following background will be sufficient to clarify the conditions, problems, and issues.

The state of Quincy has enacted a number of laws to protect its environment. The agency charged with executing these laws is the Quincy Commission on Environmental Quality (CEQ). This commission is staffed by scientists and engineers who investigate potential violations and recommend possible solutions. The commission's actions and policies, however, are determined by the CEQ board, a seven-member panel of interested citizens. Each board member is appointed by the governor for a four-year term.

In this case the CEQ board is faced with the problem of Industrial Disposal Systems, Inc. (IDSI). IDSI operates an industrial waste incinerator near Warrington, Quincy. They dispose of various solvents, greases, oils, paints, chemicals, acids, and organic compounds. Because of the properties of various waste products, the combustion of the products produces a large amount of black smoke with a high particulate content. Over the years there have been many problems with IDSI--complaints from neighbors, permit violations, and a major fire. Conditions have reached the point where many people are now calling on the CEQ to take action to close Industrial Disposal Systems.

IDSI began operation in Warrington in 1977. At that time it disposed of waste products from various large manufacturing firms in Quincy and surrounding states, and it was issued an air pollution operating permit by the Quincy CEQ. Industrial Disposal's equipment was suited to the disposal of only some chemical wastes; many other chemicals were so corrosive that they would burn out the equipment almost immediately. Since the beginning of its operation, there were complaints about the smoke coming from the IDSI incinerators.

Spurred by these complaints, Bear Paw County authorities inspected the Industrial Disposal facilities in 1979. They found that much of the company's pollution control equipment had been corroded because of the acidic nature of the waste incinerated. IDSI continued its operation even after the plant was found in violation of its air pollution operating permit.

The Commission on Environmental Quality and Bear Paw County jointly sought a temporary restraining order against the company. Although a district court judge issued the order, a day later the order was overturned, and the company was allowed to continue operation. The court did, however, require IDSI to install some new pollution control equipment by late 1982. This equipment consisted mainly of platinum fan blades which would be highly resistant to corrosion. The cost of this equipment was extremely high.

At the same time one of Industrial Disposal's largest customers--one which accounted for nearly 60 percent of the company's income--built its own incinerator facility and stopped doing business with IDSI. With this drop in income, IDSI cancelled its order for the new equipment. Shortly after this time, the company was forced to discontinue operation.

IDSI did not operate for nearly six months. Then, in 1983 the company proposed to go back into operation, using afterburners to control particulate emissions. Industrial Disposal Systems was issued four operating permits by the Commission on Environmental Quality in 1983--an air pollution operating permit, a water quality permit for a settling basin system, a water quality permit for storage sites of three containment basins which provide emergency storage of any spilled chemicals, and a temporary solid waste permit.

After the company went back into operation, it began to accept increasing quantities of waste materials. Thousands of barrels of waste were stored on the IDSI site. Many of the barrels contained chemicals which Industrial Disposal could not incinerate. The plant also continued having equipment problems, and many complaints were received by Warrington, Bear Paw County, and state officials. In the summer of 1984 a fire on the company site sent huge clouds of black smoke into the air. Warrington Fire Department officials became increasingly concerned about the build-up of waste at IDSI. Other complaints and violations by the company led to a call for action on the part of the Commission on Environmental Quality. The board met in the fall of 1985 to consider actions to be taken in the Industrial Disposal Systems case. At that time the air pollution control equipment was in disrepair, 20-30,000 barrels of hazardous waste were stored on the site, and the company was in violation of all of its permits.

Handout 4b: BARRELS OF GOO ACTIVITY TIMELINE

	Day 1	Day 2	Day 3-4	Day 5	Day 6	Day 7
CEQ Board	--Participate in introductory activities --Receive role assignments, form groups --Prepare for preliminary hearing	--Conduct preliminary hearing --Prepare and distribute press release --Receive handout 4g; begin research	--Conduct research in order to prepare questions on alternative courses of action --Prepare for running board meeting	--Compare research findings in class --Finalize preparation for running board meeting	--Conduct board hearing --Listen to presentations of other groups --Question other groups on cost/benefits of alternative courses of action --Reach decision	--Discuss how Quincy will be affected by decision --Participate in class discussion and debrief
Close the IDSI Plant Group Let IDSI Decide What To Do About the Plant Group Negotiate an Agreement Group	↓	--Participate in preliminary hearing --Identify reasons for group's course of action --Begin research	--Research --Identify supporting evidence	--Compare research findings in class --Select spokesperson and three witnesses --Prepare presentations for meetings	--Make group presentations --Answer questions from other groups --Listen to other groups' presentations --Ask questions of other groups	↓

Handout 4c: INSTRUCTIONS TO GROUP LEADERS

YOUR PRIMARY TASKS ARE TO ASSEMBLE YOUR GROUP AND GUIDE THE GROUP IN PREPARING A LOGICAL ARGUMENT FOR ITS POSITION. HELP THE GROUP SELECT A SPOKESPERSON AND UP TO THREE WITNESSES WHO WILL BE CALLED ON TO SPEAK AT THE HEARING. EACH GROUP MEMBER SHOULD PRESENT AND EXPLAIN AT LEAST ONE REASON FOR THE GROUP'S POSITION. YOUR GROUP SHOULD TRY TO PROVIDE AS MUCH STRONG EVIDENCE AS POSSIBLE TO SUPPORT ITS POSITION. BE SURE EVERYONE HAS LOOKED CAREFULLY AT THE AVAILABLE DATA. YOU SHOULD ALSO CONSIDER ALL THE CONSEQUENCES OF THE VARIOUS ALTERNATIVES BEING DISCUSSED.

Handout 4d: RISK ASSESSMENT

It is important to clearly understand the implications of the issue facing your group. One way of doing this is to assess the risks involved in allowing the Industrial Disposal Systems plant to continue to operate as it is.

Use the following questions and information from your role cards to make this risk assessment.

1. What potential negative effects may result from allowing the IDSI plant to continue to operate as it is?
    a. Who will be likely to experience these effects?
    b. Where or how widely will these effects be experienced?
    c. How soon are these effects likely to be experienced?
    d. How easy will it be to reverse these effects? Why?

2. How great are these negative effects likely to be?
    a. How many people and what type are likely to be affected physically or psychologically?
    b. How great is the environmental damage likely to be?
    c. How costly are these effects likely to be?

3. What are the chances that these negative effects will actually occur?

Handout 4e: PRESS RELEASE

STATE COMMISSION ON ENVIRONMENTAL QUALITY CONSIDERS RISKS FROM TOXIC WASTE

At a preliminary hearing yesterday the State Commission on Environmental Quality discussed the risks involved with toxic waste disposal methods used at the plant operated by Industrial Disposal Systems, Inc. Among the questions considered were:

--What are the likely negative effects?

--How great are these negative effects likely to be?

--What are the chances that these negative effects will actually occur?

Potential negative effects identified by various spokespeople at the hearing included. . .

There were speculations on the extent of these effects. Some of those discussed were. . .

Much of the discussion focused on the likelihood that these various effects would occur. General feelings included. . .

Handout 4f: BARRELS OF GOO GROUP WORKSHEET

PART I: Participants

Name of Your Group's Spokesperson:

____

Name of Your Group's Witnesses:

____

____

____

Other Group Members:

____

____

____

____

PART II: A Recommended Course of Action

1. State clearly the course of action your group believes would be best to follow:

____

____

2. Based on the information presented in your role cards and in the "Background Notes", what are all the possible reasons for your position? For example, if your group advocates the proposed expansion, its reasons may include:

   --The health hazards associated with IDSI have not been proven.

   --IDSI is faced with a clear case of over-regulation.

   --If the plant is closed there will be no way of knowing where or how the hazardous wastes are being disposed of.

   LIST YOUR GROUP'S REASONS IN THE SPACES ON THE LEFT-HAND SIDE OF THE CHART ON PAGE 2 OF THIS WORKSHEET. EACH GROUP MEMBER SHOULD IDENTIFY AT LEAST ONE REASON.

PART III: Research

Through data card and library research, find information to support each reason you listed for question 2. For example, look at the first reason above--"health hazards have not been proven." What evidence is available to support this reason? ENTER YOUR REFERENCE ON THE RIGHT-HAND SIDE OF THE CHART ON PAGE 2.

	Reasons	Supporting Information
A.		
B.		
C.		
D.		
E.		
F.		

PART IV: Costs and Benefits

1. Outline briefly the costs and benefits of taking the course of action recommended by your group. This information will help you clearly state arguments for your position during the public hearing. Cite references you have identified next to specific costs and benefits.

   An example is provided for you here.

   Example: Close the IDSI plant.

Costs	Benefits
--loss of jobs to community	--better living and working environment in community
--loss of tax income to community per cost	--easier to attract other "clean" industries to community
--costs to dispose of barrels of waste elsewhere	--less risks of health problems for residents
--possible ground water contamination from barrels of sludge and ash	

Your Group's Alternative Course of Action: ______________________________

____

____

Cost	Reference	Benefit	Reference

Use a separate sheet of paper if necessary.

Handout 4g: COMMISSION ON ENVIRONMENTAL QUALITY BOARD GROUP WORKSHEET

Your group is charged with making a decision on the Industrial Disposal Systems plant. You must decide what is to be done on this issue. What conditions are to be established? What process or techniques will be used? Who will be responsible for taking the necessary action? How are these conditions to be established? Of course, many questions must be raised and answered.

PART I: Alternative Courses of Action

As a group, you should clarify the possible courses of action which may be taken in this case. List these alternative courses of action below (remember, each alternative for regulation should consider WHAT, HOW, and WHO):

1. ______________________________

____

2. ______________________________

____

3. ______________________________

____

4. ______________________________

____

5. ______________________________

____

PART II: Questions for the CEQ Board Hearing

During the CEQ hearing, you will want to ask questions of each group to help clarify their arguments. This will help you to make a good decision. Each role has several questions or concerns. These should be listed, along with other questions that come to mind, in the appropriate areas below. Some questions may be asked of more than one group. Finally, you will spend time researching answers to these questions and educating yourselves. You want to be knowledgeable decision makers. Place the data card references you find that you think help to answer the questions on the worksheet.

ALTERNATIVE 1: ______________________________

____

	Question	Reference
A.	______________	______________
	______________	______________
	______________	______________
B.	______________	______________
	______________	______________
	______________	______________
C.	______________	______________
	______________	______________
	______________	______________
D.	______________	______________
	______________	______________
	______________	______________

ALTERNATIVE 2: ______________________________

____

	Question	Reference
A.	______________	______________
	______________	______________
	______________	______________
B.	______________	______________
	______________	______________
	______________	______________

C. ____________________ ____________________

D. ____________________ ____________________

ALTERNATIVE 3: ______________________________

Question	Reference
A.	
B.	
C.	
D.	

PART III: Costs and Benefits

For each alternative presented during the meeting, outline the costs and benefits of taking that course of action. COMPLETE THIS SECTION DURING THE CEQ HEARING. A partial example for one alternative course of action is provided for you. Be sure to add costs and benefits as they are mentioned by the groups and to ask for clarification where necessary. This will help you make your final decision.

Example: Close the IDSI plant.

Costs	Benefits
--loss of jobs to community	--better living and working environment in community
--loss of tax income to community	--easier to attract other "clean" industries to community
--costs to dispose of barrels of waste elsewhere	--less risk of health problems for residents
--possible ground water contamination from barrels of sludge and ash	

Group 1, Proposed Course of Action: ________________________________

____

____

____

Cost	Reference	Benefit	Reference

Group 2, Proposed Course of Action: ______________________________

____

____

____

Cost	Reference	Benefit	Reference

Group 3, Proposed Course of Action: ______________________________

____

____

Cost	Reference	Benefit	Reference

Handout 4h: SUGGESTED RESOURCES ON INDUSTRIAL WASTE

Listed below are some journal articles, library resources, and contact organizations to get you started on compiling information for the upcoming CEQ board hearing. Note: Some of your best information will come from recent newspaper and magazine articles, so be sure to check the Readers' Guide to Periodical Literature, Magazine Index, and any newspaper indexes available in your school or local library.

LIBRARY RESOURCES

Annual Editions: Environment 84/85. Guilford, CT: Dushkin Publishing Group, 1984.

Annual Editions: Health 84/85. Guilford, CT: Dushkin Publishing Group, 1984.

Collins, Carol, ed. Our Food, Air, and Water. Editorials on File. New York, NY: Facts on File, Inc., 1985. A compilation of editorials debate the pros and cons of nuclear energy and related issues.

Facts on File. New York, NY: Facts on File, Inc., 1985. A weekly digest and index of news, compiled from major national and international newspapers.

Goldman, Jill S., and others. Investigations: Toxic Waste. Cambridge, MA: Educators for Social Responsibility, 1984.

Pollution. Boca Raton, FL: Social Issues Resource Series, Inc. (SIRS), 1985. A "vertical file" of journal and newspaper articles.

Taking Sides: Clashing Views on Controversial Environmental Issues. Guilford, CT: Dushkin Publishing Group, 1984.

JOURNAL ARTICLES

Beecher, John L., and Arthur J. Fossa. "The Problem of Toxic Wastes." Conservationist 34(March-April 1980):33-35.

"Detoxifying Industrial Waste Waters." Environmental Science and Technology 10(February 1976):127-129.

Pfortner, Ray. "The Control of Hazardous Wastes and the Role of Environmental Education." Native Study 37(March 1984):43-44.

JOURNALS

Conservationist

Environment

Environmental Science and Technology

National Geographic

Pollution Abstracts

Science Digest

CONTACT ORGANIZATIONS

Center for Environmental Education. 2100 M St., NW, Washington, DC 20037.

The Conservation Foundation. 1717 Massachusetts Avenue, NW, Washington, DC 20036.

Council on Environmental Quality. 722 Jackson Place, NW, Washington, DC 20006.

Environmental Action Foundation, Inc. 724 DuPont Circle Bldg., Washington, DC 20036.

Environmental Protection Agency. 401 M St., SW, Washington, DC 20460 (Publications: Primer on Wastewater Treatment; Is Your Drinking Water Safe?)

State "Public Interest Research Group" (e.g., CoPIRG (Colorado) NCPirg (North Carolina)

Water Pollution Control Federation/Wilderness Society. 1901 Pennsylvania Avenue, NW, Washington, DC 20006

Handout 4i: HOW TO RUN A COMMISSION ON ENVIRONMENTAL QUALITY BOARD HEARING

1. Announce the purpose of the meeting at the beginning.

2. Strictly enforce time limits on each group.

3. In order to maintain control:

   --Have all comments addressed to you.

   --Call on people who raise their hands.

   --As much as possible, give each group equal time.

   --Stress the need for participants to refer to specific sources of information when presenting arguments.

   --Question group members, but don't squabble with them.

   --Have presenters initially state their names, places of residence, if possible, and professions.

4. Your agenda should be:

   a. Close-the-IDSI-plant group

      (1) Group leader

      (2) Maximum of three additional witnesses

      (3) Questions to that group from the hearing examiners

   b. Let-the-IDSI-decide-what-to-do-about-the-plant group (same as above).

   c. Negotiate-on-agreement group (same as above).

   d. General discussion and questions from the hearing examiners.

   e. Concluding remarks (1 minute) from each group.

   f. Hearing examiners confer, then announce decision.

   g. Discussion of reasons for chosen course of action.

State of Quincy
United States of America

DATA CARD #1

QUINCY AIR POLLUTION CONTROL

Regulation 7(b)

No person shall cause or permit the emission of particulate matter from the stack or chimney of any incinerator in excess of 0.1 grains of particulate matter per standard dry cubic foot of exhaust gas.

Regulation 9(b)

No person shall cause, permit, or allow emission into the air of odorous air contaminants in excess of 1,000,000 odor concentration units per minute.

Regulation II(b)

No person shall discharge into the atmosphere from any single source of emission whatsoever any air contaminant which has a shade or density:

1. darker than that designated at No. 1 on the Ringelmann Smoke Chart; or

2. of such opacity as to obscure an observer's view beyond one mile.

DATA CARD #2

Quincy Commission
on Environmental Quality
Lakeville, Quincy 71740

QUINCY WATER POLLUTION CONTROL

Regulation 14 (C) (2)

No sewage, industrial waste, or other wastes shall be discharged into any waters of the state so as to cause any nuisance conditions, such as the presence of significant amounts of floating solids, scum, oil slicks, excessive suspended solids, material discoloration, obnoxious odors, sludge deposits, slimes or fungus growths, or other offensive or harmful effects.

Regulation 22 (d) (4)

Toxic pollutants including, but not limited to, radioactive substances, chemicals, metals, solvents, petroleum products, plating wastes, and acid bases shall not be discharged or deposited in any manner such as to endanger the quality or uses of the underground waters.

DATA CARD #3
(1 of 2)

Quincy Commission
on Environmental Quality
Lakeville, Quincy 71740

January 24, 1983

PERMIT FOR CONSTRUCTION AND OPERATION OF DISPOSAL SYSTEM

INDUSTRIAL DISPOSAL SYSTEMS, INC.

Pursuant to authorization by the Quincy Commission on Environmental Quality, and in accordance with the provisions of Quincy Statutes, Chapters 115 and 116, plans are approved and a permit is hereby granted to Industrial Disposal Systems, Inc., for construction and operation of a settling basin system at the IDSI plant in Warrington, Bear Paw County.

The facilities consist of three settling ponds for sludge from the IDSI incinerators. The sludge is to be removed periodically and deposited in an approved landfill.

OPERATING PERMIT FOR INDUSTRIAL WASTE INCINERATOR AIR POLLUTION ABATEMENT EQUIPMENT

INDUSTRIAL DISPOSAL SYSTEMS, INC.

Pursuant to authorization by the Quincy Commission on Environmental Quality, and in accordance with the provisions of Quincy Statutes, Chapters 115 and 116, an Operating Permit is hereby granted to Industrial Disposal Systems, Inc., for operation of air pollution abatement equipment to reduce particulate emissions from the two incinerators presently on the company's site in Warrington, Bear Paw County.

This permit is based on the promise of continued effective performance of the air pollution control equipment in accordance with Commission regulations.

Data Card #3
(2 of 2)

January 24, 1983

PERMIT FOR CONSTRUCTION AND OPERATION OF LIQUID STORAGE FACILITIES

INDUSTRIAL DISPOSAL SYSTEMS, INC.

Pursuant to authorization by the Quincy Commission on Environmental Quality, and in accordance with the provisions of Quincy Statutes, Chapters 115 and 116, plans are approved and a permit is hereby granted to Industrial Disposal Systems, Inc., for construction and operation of liquid storage facilities at the IDSI plant in Warrington, Bear Paw County.

The facilities consist of a storage site of three containment basins which provide emergency storage of any spilled chemicals, as follows:

Basin Size	Number Tanks	Volume	Material of Construction
a) 41,000 gallons	10	10,000 gallons	concrete
	1	7,000 gallons	
	1	5,000 gallons	
b) 10,000 gallons	8	1,000 gallons	concrete

In addition, the company may stockpile for future disposal not more than 5,000 barrels of 55 gallons capacity each. These barrels are to be stacked on pallets on a compacted clay basin.

272

DATA CARD #4

E.W. Melek & Associates
Attorneys at Law

August 15, 1984

Mr. John Kreiger
Bear Paw County Administrator
Warrington, Quincy 71832

Dear Mr. Kreiger:

Please be advised that I represent Industrial Disposal Systems, Inc., of Post Office Box 481, Warrington, Quincy.

Mr. Barton Stone of Industrial Disposal has asked me to make sure that the company either has or obtains all proper permits and licenses. The company presently holds licenses from the Quincy Commission on Environmental Quality and I believe from the State Fire Marshall, and application has been made to the city of Warrington for some building permits. To make sure that we are covering all fronts, I would appreciate it very much if you would check to see if the county requires any type of permit or license for the Industrial Disposal Systems' operation.

Sincerely,

E.W. Melek

EWM/ja

CC: Industrial Disposal Systems, Inc.

DATA CARD #5

BEAR PAW COUNTY

Warrington, Quincy 71832

November 2, 1984

E.W. Melek
Attorney at Law
312 West Post Road
Warrington, Quincy 71830

Dear Mr. Melek:

This letter is to advise you that Bear Paw County has on file a Solid Waste Ordinance, which includes regulation of hazardous waste and the incineration of these materials. A copy of the ordinance is being sent to you.

On page 15 of this ordinance, the section referring to disposal of hazardous waste begins. Under Subsection 1 of Section III, all application fees must be paid before the license will be granted. The information in parts (A) through (E) must be sent along with the application. Any additional information, as stated in part (F), may be required at a later date. Under part (G) you must show proof that the city of Warrington has inspected and approved the Industrial Disposal Systems, Inc., facilities.

The regulations under which the company will operate are specified in Section III, Subsection 4 (pages 15-18).

Also in Section II, Subsection 4 (pages 4 and 5) there are specific requirements for insurance which will have to be met.

I would like to hear from you on this matter as soon as possible.

Very Truly Yours,

H.G. Ingvold
Planning and Zoning
Coordinator

DATA CARD #6

INDUSTRIAL DISPOSAL
SYSTEMS, INC.
P.O. Box 481
Warrington, Quincy 71826
Phone (888) 461-3721

November 7, 1984

H.G. Ingvold
Planning and Zoning
Bear Paw County
Warrington, Quincy 71832

Dear H.G. Ingvold:

We recognize the fact that we need a Bear Paw County license; however, it appears to us that the fee required is inordinately high. In as much as fees to operate landfills and other facilities which generate very heavy traffic and cost the county money for such things as road maintenance are disproportionately low, we hereby request consideration of the matter. We would be happy to appear before the commissioners and state our position if you think it worthwhile.

Sincerely,

Barton Stone
President

DATA CARD #7
(1 of 2)

IDSI
INDUSTRIAL DISPOSAL
SYSTEMS, INC.
P.O. Box 481
Warrington, Quincy 71826
Phone (888) 461-3721

January 8, 1985

Interested Persons:

After several discussions with officials of the State Fire Marshall's office, Quincy Commission on Environmental Quality, Bear Paw County, and the City of Warrington, Industrial Disposal Systems, Inc., has pledged itself to take the following actions:

1. Reduce its barrel inventory by burning 10 percent more than is received. This will be substantiated by monthly reporting.
2. Begin labelling of incoming barrels according to federal standards, if not labelled by customer.
3. Segregate and properly stack solids and nonflammables. An attempt will be made to pump all flammable liquids as they arrive on site.
4. Install fire lanes in the barrel storage area.
5. Provide better housekeeping procedures.

To institute these programs requires the following action by others:

1. A permit from the CEQ for additional 8-12,000-gallon storage tanks.
2. An operating permit from Bear Paw County.
3. A permit from the CEQ for acid neutralization and oil and solvent reclaiming.
4. Approval from the CEQ and others for temporary additional barrel storage.

To double its plant capability, IDSI now has underway a reconstruction program on Side No. 2; however, delivery date on new equipment is eight to twelve weeks.

Our long range plans will include asking the City of Warrington to work with us in an industrial revenue bond program to build a new modern facility which may be designed to handle the following:

1. Chemical wastes (waste steam to be converted to electricity to serve the city's needs.)

2. Solid wastes (by incineration).

3. Sewage sludges (chemical fixation for conversion to fertilizer).

4. Heavy metal and solvent recovery for return to the manufacturing stream.

5. Drum reconditioning for use by all of our 300 customers in the metropolitan area.

We have employed some very competent technical personnel to assist us in this program, and to implement the program it will take the cooperation and support of all involved. On behalf of Industrial Disposal Systems, Inc., we will make every attempt to comply with any requests and suggestions made by the various parties.

Sincerely,

Barton Stone
President

DATA CARD #8
(1 of 2)

BEAR PAW COUNTY
COURT HOUSE Warrington, Quincy 71832

MEMORANDUM

To: H.G. Ingvold

From: A.M. Willette

Subject: Industrial Disposal Systems, Inc.--Daily Inspections

Monday, March 4, 1985 9:00 A.M.

Plant was in operation. Some overflow of smoke coming from the front end of burner. There does not appear to be any improvement in the restacking of barrels to meet local fire codes. The southwest corner of the property has been almost totally cleared to make way for restacking. Some gravel has been brought in for leveling the area.

Tuesday, March 5, 1985 9:00 A.M.

Plant has not been in operation since sometime yesterday due to minor repairs being required.

The last barrels have been removed from the restacking area. A clay/gravel mixture has also been brought in and a dike has been started around the restacking area.

IDSI is still pumping sludge material into the dike that surrounds a large tank on location. This dike has been erected to catch any spillage of fuel oil should the tank rupture. There is at present less than 6" of clearance.

Wednesday, March 6, 1985 9:00 A.M.

Plant still not in operation. IDSI began moving barrels to the new restacking area. It was discovered that the sludge material within the dike area is within 1-2 inches from overflowing. I was told that the situation would be rectified as soon as CEQ directs IDSI where to take the sludge material. No new violations evident.

Thursday, March 7, 1985 4:30 P.M.

Plant was in operation. I was informed that the incinerator was fired up late Wednesday afternoon. There was no change in restacking from yesterday morning. While I was there, smoke began overflowing through the front of the burner, but the matter was immediately taken care of.

DATA CARD #8
(2 of 2)

Friday, March 8, 1985 4:30 P.M.

Plant was in operation. I inspected a new sensing device installed at the front of the burner to detect smoke overflowing through the front. At that point the sensing device would automatically turn off the auger. I feel this device will be an improvement to the operation because the smoke coming from the front has not been cleared and therefore is probably a large cause of the odor problem.

279

DATA CARD #9

BEAR PAW COUNTY
COURT HOUSE Warrington, Quincy 71832

MEMORANDUM

To: H.G. Ingvold
From: A.M. Willette
Subject: Industrial Disposal Systems, Inc.--Daily Inspections

Monday, March 18, 1985 3:30 P.M.

Plant was in operation. Approximately 1,000 barrels have been properly placed in the new restacking areas. The two-foot dike has been constructed around this area, except on the north side.

Tuesday, March 19, 1985 4:30 P.M.

Plant was in operation. There is still a minimal amount of restacking being done. It is unlikely that IDSI will be able to meet the order of the City of Warrington on compliance of the city fire codes.

Wednesday, March 20, 1985 3:00 P.M.

Plant was in operation. I found a liquid flowing from the plant area into the trench south west of the incinerator. I do not know whether the liquid was water or a sludge waste from the plant.

Thursday, March 21, 1985 3:30 P.M.

Plant was in operation. Additional barrels have been moved. Within last ten days some progress has been made on restacking. If IDSI had progressed, during the last two months, as fast as they are now, they might have been able to meet the stacking codes as recommended by the Fire Marshall's office.

Friday, March 22, 1985 8:45 A.M.

Plant was in operation. No change from yesterday afternoon. Barton Stone stated that between the city, county and other organizations all making frequent inspections, his key personnel are being taken from their jobs too often during the day. I stated that I would inform the board of his statement.

DATA CARD #10

BEAR PAW COUNTY
COURT HOUSE Warrington, Quincy 71832

MEMORANDUM

To: H.G. Ingvold

From: A.M. Willette

Subject: Industrial Disposal Systems, Inc.--Daily Inspections

Monday, April 1, 1985 4:30 P.M.

Plant was not in operation. A crane was on location installing a fan into the Number Two burner. There was no change in the restacking area. The lab is in the process of analyzing sludge and ash to determine whether the material is safe for landfilling.

Tuesday, April 2, 1985 8:45 A.M.

Plant was in operation. The fan for Number Two side has been totally installed. Employees were restacking in the southwest corner. It is doubtful that they will be able to meet fire regulations by the end of the month.

Wednesday, April 3, 1985 4:00 P.M.

IDSI will not be in operation for the next two to three weeks. A decision was made by Barton Stone to close the operation because of potential problems with the fan and fan housing on Number One side. I inspected the fan housing and found that it had thinned in many areas and even had some substantial holes. The fan itself was also quite corroded. I was told that CEQ would allow no further incoming material until Number Two side was in operation.

Thursday, April 4, 1985 10:00 A.M.

I made an inspection of two truckloads of material that had been brought to the location before the decision was made to close the plant. Because the materials had been accepted by IDSI but are unable to be incinerated and are still on the trucks, the materials will have to be stockpiled temporarily on the site. IDSI had made assurances that there would be no more stockpiling, but because of these unforseen circumstances, they wanted to keep everything above board. Mr. Stone also stated that the workers would be kept on to do the necessary restacking and to help bring Number Two side into operation.

Friday, April 5, 1985 2:00 P.M.

Incinerator was not in operation. Employees were dismantling fan from housing on Number One side. Fan can probably not operate effectively because of the corrosion.

DATA CARD #11

BEAR PAW COUNTY
COURT HOUSE Warrington, Quincy 71832

MEMORANDUM

To: H.G. Ingovold

From: A.M. Willette

Subject: Industrial Disposal Systems, Inc.--Daily Inspections

Monday, April 15, 1985 4:30 P.M.

Incinerator was not in operation. Restacking was again taking place. Approximately 1,100 barrels have now been moved and properly located.

Tuesday, April 16, 1985 8:15 A.M.

Incinerator was not in operation. It was explained to me that a new stack would be installed before Number Two side could be brought into operation. A portion of the lower stack was on the site. Dismantling of the old stack was not evident. Restacking was continuing. Most of the barrels on the northwest portion of the property have now been either restacked or moved into location for future incineration.

Wednesday, April 17, 1985 3:30 P.M.

An area directly west of the existing tank is being cleared to make way for a large pad and dike which would be used with the five or six large tanks that are lying around the area. The removal of these tanks to a new tank area will greatly increase the area where proper restacking could take place.

Thursday, April 18, 1985 4:30 P.M.

Incinerator was not in operation. Work on the fan for Number Two side was continuing. Restacking is taking place with about 1,300 barrels being restacked.

Friday, April 19, 1985

No Inspection.

DATA CARD #12

City of Warrington

417 Main Street 71832 founded 1841

May 3, 1985

Industrial Disposal Systems, Inc.
P.O. Box 481
Warrington, Quincy 71826

Attn: Barton Stone

Mr. Stone:

You are hereby ordered to CEASE and DESIST from:

1) Further stockpiling any chemical waste on your site in Warrington, Quincy.

You are hereby ordered to:

2) Provide a burn schedule for reducing the number of barrels on your site to 5,000 in one year's time.

3) Provide within thirty (30) days and maintain fire lanes at the site.

4) Label all containers within the next sixty (60) days.

5) Dispose of all leaking and deteriorating barrels within ninety (90) days.

6) Take immediate action regarding a complete clean up of all debris now on the IDSI site.

If you do not comply with this order, the city of Warrington will take immediate legal steps against your company.

Harvey L. Lee
Building Officer
Warrington, Quincy 71832

DATA CARD #13

BEAR PAW COUNTY
COURT HOUSE Warrington, Quincy 71832

MEMORANDUM

To: H.G. Ingvold

From: A.M. Willette

Subject: Industrial Disposal Systems, Inc.--Daily Inspections

Monday, May 6, 1985 8:45 A.M.

Incinerator was not in operation. Employees were working on the fan and fan housing for Number Two side. There are now approximately 1,500 barrels properly stacked.

Tuesday, May 7, 1985 8:30 A.M.

Incinerator was not in operation. Activity is still centered around Number Two side. IDSI is reconditioning the fan housing in order to begin operation. Approximately 1,600 to 1,700 barrels have been restacked.

Wednesday, May 8, 1985 3:30 P.M.

The Warrington City Council has sent IDSI a Cease and Desist Order. Thus, there was no activity in any part of the plant area. There was also no change in the status of Number Two side or the restacking of barrels to meet fire code regulations. It also appears that there may be no change until legal problems are worked out.

Thursday, May 9, 1985 3:30 P.M.

Number Two side fan and fanhousing appear to be almost completely reconditioned. Work has started on removing the barrels from west of the existing tank area to make room for the additional storage tanks that they intend to install.

Friday, May 10, 1985 4:00 P.M.

Work continues on the restacking. Close to 2,000 barrels have been moved and stacked according to state regulation. Clearing of barrels in the central portion of the facility is continuing to open areas for the new tank area and to create an area for further restacking.

DATA CARD #14

INDUSTRIAL DISPOSAL
SYSTEMS, INC.
P.O. Box 481
Warrington, Quincy 71826
Phone (888) 461-3721

June 17, 1985

Dear Customer:

Industrial Disposal Systems, Inc., is presently serving over 300 customers with disposal service by high temperature incineration of toxic and hazardous waste. The rapid growth of our business, both in the number of customers served and total gallons processed, has been well beyond our most optimistic projections.

To keep up with this rapid growth rate we have made numerous technical changes within the plant to increase our production capacity. In addition, we are working to complete modifications to our Number Two side, which will almost double our capacity.

This rapid growth rate has created a number of problems for our management. One large problem requires cooperation from you, our customer. This problem centers around our barrel storage facility which is made up primarily of solidified barrels.

Approximately 40 percent of the barrels received at our plant are classified as solidified barrels. This material is very difficult to remove from the barrels in order to be introduced into the combustion chamber. We have developed a new method to extract this type of material, and presently we are testing the machine for reliability. Once this testing is completed, we will be in a position to determine what positive effect this will have on our production rate.

For the next 90 days it will be necessary to restrict our acceptance of barrels which are classified as solids or barrels which are classified as polymers. We are aware that this may create problems for many of you. If this does create a problem, please contact us and we will endeavor to work out a satisfactory solution for all concerned.

We appreciate the confidence you have placed in Industrial Disposal Systems, Inc., and we will continue to make every effort to retain that confidence.

Sincerely,

Barton Stone
President

DATA CARD #15
(1 of 5)

BEAR PAW COUNTY
Warrington, Quincy 71832

July 15, 1985

Mr. Barton Stone
Industrial Disposal Systems, Inc.
P.O. Box 481
Warrington, Quincy 71826

Dear Mr. Stone:

Pursuant to Section V, Subdivision 3 of the Bear Paw County Solid Waste Ordinance, it is unlawful for any person to construct, establish, maintain, or operate an incinerator without first acquiring a license from the County Board.

At the present time, Industrial Disposal Systems, Inc., is operating without a license from Bear Paw County. As stated in the above mentioned ordinance, certain information must be included in a plan for your company. This plan must be approved before a license will be issued. The plan shall include:

A. A map showing:

    1. Land use.
    2. Future construction plans.
    3. Location, type, and use of all buildings.
    4. Location of all wells.
    5. Utilities.
    6. Roads and railways.
    7. Surface water drainage patterns.
    8. Waste storage areas.
    9. Surface water bodies.
    10. Wetlands.

B. A plan for groundwater monitoring. This plan shall show at a minimum:

1. Location of meters for determining groundwater flow.

2. Soil borings indicating both soil types and groundwater elevations.

3. Cross section which indicates soil type, water level, and proposed elevations of groundwater monitoring wells.

4. Method of identification of material in storage.

C. An engineering report on furnace designs with the following:

1. Dimensions of all burning chambers and incinerator specifications in general.

2. Volume calculation of the effective air space in all chambers.

3. Location of equipment to monitor burning chambers.

D. In an individual report there shall be developed a plan for the proper storage of all incoming wastes. This shall include:

1. Removal of all materials which are not essential to incinerator operations, such as used tires and scrap metal.

2. The development of a color coding system in addition to labeling system to distinguish different waste, such as acids, in barrels.

3. The development of dikes, clay liners, and separate storage areas for flammable liquids and solids.

4. A plan for reducing barrel storage to 5,000 barrels within six months either by bulk storage, subcontracting to another incinerator, or destruction of the waste.

E. Listing of all fire fighting equipment, safety equipment, and other emergency services available. The plan shall include:

1. Relation of fire lanes to storage tanks and drum storage.

2. Fire fighting equipment location.

3. Method of storage and stacking of drums.

4. Method of identification of material in storage.

F. Development of a spill emergency plan. This plan shall include the following:

1. Purchasing of equipment necessary to contain any spill from tank trucks or barrels at the facility.

2. Method of sealing spillage from groundwater.

3. Method of reporting spillage.

G. A copy of all forms or agreements used at the facility, including but not limited to:

1. Source of the waste.

2. Transportation of the waste.

3. Chemical analysis of the waste.

4. Date of receipt.

5. Date of incineration.

H. Plans for the disposal of incinerator residue and emergency disposal of solid waste in the event of major incinerator plant breakdown.

I. A list showing the present and future customers to be served by the incinerator and the characteristics, quantities, and sources of the waste to be incinerated.

J. A bond shall be provided to the county as stated in Section II-Subdivision 4 of the Bear Paw County Solid Waste Ordinance. This bond shall be presented within 45 days of the receipt of this letter, and shall be in the amount of $25.00 per barrel of the stockpiled material. Every month the bond can be reduced to reflect the reduction of barrel storage. The records showing amounts received and destroyed shall be certified as to accuracy by the Plant Manager and approved by the Planning and Zoning Coordinator.

We are requesting that this information be returned to us within 45 days from the receipt of this letter. At that time, all agencies involved will have time to study the plans prior to their acceptance or requests for changes.

If you have any questions, do not hesitate to contact the Planning and Zoning Coordinator.

Sincerely,

J.S. Kircher
Bear Paw County Board of
Commissioners

WK:lw

cc: County Attorney
County Planning & Zoning Coordinator

DATA CARD #15
(5 of 5)

Company Name: Industrial Disposal Systems, Inc.

Address: P.O. Box 481
Warrington, Quincy 71826
Telephone Number: (888) 461-37826
Contact Person: Barton Stone, President

C. Licensed by:
Quincy Commission on Environmental Quality

I. Background

A. Services Provided or Arranged

	Provided	Arranged
-Collection/hauling	x	
-Recycling/reclamation		
-Processing/treatment	x	
-Incineration	x	
-Land disposal		
-Testing hazardous waste samples	x	

B. Service Area

-All of Quincy	x	
-Counties listed below:		

II. Waste Processing

A. Please complete the table, indicating the waste types your firm accepts, the disposal and/or treatment method your firm uses and the cost to your customers.

Type of Waste Accepted	Disposal Method	Cost to Customer (per barrel)
1. Pesticides	* N.A.	-
2. Acids	* Incin.	$10-50
3. Caustics	Incin.	$10-50
4. Mercury Compounds	N.A.	-
5. Cyanides	N.A.	-
6. Phosphorous Compounds	Incin.	$10-50
7. PCB's	N.A.	-
8. Oils	Incin.	$10-50
9. Plastics	Incin.	$10-50
10. Solvents	Incin.	$10-50
11. Resins	Incin.	$10-50
12. Paints	Incin.	$10-50
13. Explosive	N.A.	-
14. Phenols	Incin.	$10-50
15. Radioactive	N.A.	-

* N.A. = Not Accepted
* Incin. = Incinerated

DATA CARD #16

BEAR PAW COUNTY
COURT HOUSE Warrington, Quincy 71832

MEMORANDUM

To: H.G. Ingvold
From: A.M. Willette
Subject: Industrial Disposal Systems, Inc.
Date: July 20, 1985

Tests are being made twice a month to monitor the ground water supply in and around the IDSI site. The latest tests show that the following water quality standards have been exceeded:

Arsenic	by 5 times the allowed concentration
Barium	by 2 " " " "
Cadmium	by 2 " " " "
Lead	by 3 " " " "
Selenium	by 4 " " " "
Nitrate	by 32 " " " "

Since none of these concentrations, except perhaps nitrate, are very high, dilution with additional water may effectively reduce these levels to the federal government's drinking water standards.

Some other substances in the ground water have been found to be higher than what is recommended. These concentrations affect the appearance of the water but are not high enough to pose a threat to health:

Iron	by 333 times the recommended concentration
Manganese	by 560 " " " "
Chloride	by 4 " " " "
Sulfate	by 1.2 " " " "

Another chemical that has been found is phenol which has a concentration 7 times higher than the recommended standard.

What is unknown at this time is the background concentration of each of these substances in this area and how far these chemicals (if originating from IDSI) are spreading.

DATA CARD #17

American Plumbing Supply
P.O. Box 1062
Warrington, Quincy 71826
Phone (888) 461-6124

July 21, 1985

Honorable Board of County Commissioners
Bear Paw County
Warrington, Quincy 71832

Dear Commissioners:

I am sure that by now you are well aware of our concern about the operation of Industrial Disposal Systems that is located next to our property. For more months than I can recall, we have repeatedly called Industrial Disposal, the CEQ, and others about the offensive odor and possible harmful effects of the smoke from this plant. We have found that on days when the wind is in a certain direction, the working environment for myself and my employees is almost intolerable.

We solicit your urgent action on this matter because I feel the continued operation of American Plumbing Supply is based on environmentally sound working conditions. I fear for our health, the safety of our people, and the almost inevitable possibility of another fire such as the one last year.

I don't know on what terms IDSI operates; however, I am sure they need a permit to stay in business. I would ask that the commission invite me to any future meetings whenever the subject of permit renewal comes up.

Please help us to remain a profitable tax-paying company in your county.

Sincerely,

George Kakus
General Manager

GK/ja

DATA CARD #18

IDSI
INDUSTRIAL DISPOSAL
SYSTEMS, INC.
P.O. Box 481
Warrington, Quincy 71826
Phone (888) 461-3721

July 21, 1985

J.S. Kircher, Commissioner
Bear Paw County
Warrington, Quincy 71832

Dear Mr. Kircher:

In reply to your letter of July 15, Industrial Disposal Systems, Inc., has taken the following actions:

1) We have hired a consultant to help us prepare all maps and plans.

2) We will be working with the Quincy Commission on Environmental Quality (CEQ) to develop a groundwater monitoring program.

3) Site clean-up is under way.

4) A spill emergency plan was developed for the CEQ, and a copy will be provided to you.

5) Forms from our operation will be made available to you.

6) We are discussing the bond requirement with a bank.

We will work on these matters until completed; however, this will take some time. After completion of all the items we will make a submission to your board and will be happy to meet and discuss any items with you.

Sincerely,

Barton Stone
President

DATA CARD #19

INDUSTRIAL DISPOSAL
SYSTEMS, INC.
P.O. Box 481
Warrington, Quincy 71826
Phone (888) 461-3721

MONTHLY INCOMING AND DISPOSAL REPORT

JULY 1985

	INCOMING PRODUCT		DISPOSAL	
	Barrels	Total Gallons	Barrels	Total Gallons
7/1	-	-	-	-
7/2	-	-	-	-
7/3	148	12,792	-	-
7/4	-	-	-	-
7/5	-	-	-	-
7/6	-	-	-	-
7/7		4,074	-	-
7/8	35	2,116	39	-
7/9	35	7,804	48	6,000
7/10	88	4,484	-	7,363
7/11	18	7,197	59	15,094
7/12	-	-	-	12,865
7/13	-	-	-	-
7/14	112	15,132	236	10,657
7/15	9	458	108	11,429
7/16	170	8,836	184	11,756
7/17	83	7,564	176	10,462
7/18	21	16,381	-	-
7/19	-	-	-	-
7/20	-	-	40	9,509
7/21	109	10,901	129	15,664
7/22	173	13,989	181	18,344
7/23	79	9,022	250	18,791
7/24	135	16,579	183	13,344
7/25	65	7,582	-	-
7/26	-	-	172	-
7/28	12	5,789	188	9,812
7/29	49	3,749	72	11,193
7/30	19	1,624	233	12,388
7/31	16	4,240	112	7,976
	1,376	160,313	2,410	202,647

DATA CARD #20

INDUSTRIAL DISPOSAL
SYSTEMS, INC.
P.O. Box 481
Warrington, Quincy 71826
Phone (888) 461-3721

MONTHLY INCOMING AND DISPOSAL REPORT

AUGUST 1985

	INCOMING PRODUCT		DISPOSAL	
	Barrels	Total Gallons	Barrels	Total Gallons
8/1	83	7,954	120	-
8/2	-	-	-	-
8/3	-	-	-	16,733
8/4	87	9,570	201	18,267
8/5	25	2,458	247	16,009
8/6	131	9,393	291	18,036
8/7	102	5,232	179	16,999
8/8	133	7,748	261	6,032
8/9	-	-	126	-
8/10	-	-	165	-
8/11	32	5,980	72	10,219
8/12	114	5,790	204	16,614
8/13	102	9,937	289	19,985
8/14	142	7,186	297	17,120
8/15	115	10,905	214	-
8/16	-	-	-	-
8/17	-	-	-	15,036
8/18	131	6,757	111	19,559
8/19	89	4,492	290	20,291
8/20	268	18,486	213	20,149
8/21	221	11,345	221	23,533
8/22	135	11,814	387	17,128
8/23	-	-	273	-
8/24	-	-	300	-
8/25	71	8,651	223	8,023
8/26	127	6,896	250	10,574
8/27	98	6,426	347	24,071
8/28	40	2,000	220	20,788
8/29	276	14,264	190	11,333
2/30	-	-	-	-
	2,522	173,284	5,691	346,499

DATA CARD #21

INDUSTRIAL DISPOSAL
SYSTEMS, INC.
P.O. Box 481
Warrington, Quincy 71826
Phone (888) 461-3721

MONTHLY INCOMING AND DISPOSAL REPORT

SEPTEMBER 1985

	INCOMING PRODUCT		DISPOSAL	
	Barrels	Total Gallons	Barrels	Total Gallons
9/1	-	-	-	-
9/2	35	6,523	73	10,520
9/3	149	14,414	282	19,145
9/4	68	8,225	147	12,596
9/5	308	20,301	222	14,747
9/6	-	-	147	-
9/7	-	-	-	-
9/8	35	12,143	70	15,125
9/9	211	10,703	116	19,539
9/10	79	4,218	209	16,763
9/11	141	13,518	170	10,055
9/12	184	14,050	209	17,603
9/13	-	-	-	-
9/14	-	-	-	-
9/15	121	8,103	36	4,020
9/16	-	10	102	9,518
9/17	84	11,487	122	12,832
9/18	72	3,960	168	12,232
9/19	41	2,323	185	12,024
9/20	-	-	-	-
9/21	-	-	-	-
9/22	77	3,910	28	4,712
9/23	104	5,288	182	8,792
9/24	62	10,380	174	11,328
9/25	163	8,170	112	8,400
9/26	33	6,166	222	19,812
9/27	-	-	-	-
9/28	-	-	-	-
9/29	29	1,458	-	1,394
9/30	258	17,406	207	6,736
	2,254	182,756	3,183	247,893

DATA CARD #22

Quincy Commission on Environmental Quality

TELEPHONE MEMO

Person taking call: R. B. Hosakawa
Person calling: Mr. Jerry Casper
Subject: Industrial Disposal Systems
Date: 9/3/85

This man was concerned about the IDSI situation in Warrington and expressed his doubt that the CEQ was handling the problem properly.

He especially was concerned about the air pollution problem and mentioned the court action in 1984 to get IDSI to install better equipment. The company has still not installed this equipment.

I mentioned the upcoming CEQ board meeting and suggested Mr. Casper attend this meeting to make his feelings known.

Quincy Commission on Environmental Quality

TELEPHONE MEMO

Person taking call: R. M. Wodnik
Person calling: Mrs. Langley
Subject: Industrial Disposal Systems
Date: 9/4/85

Mrs. Langley said that the odor and smoke on this day were intolerable and she was "fed up" with the IDSI operation.

She was not satisfied with the action the CEQ has taken. She said she would attend any meeting to express her belief that IDSI should be shut down completely.

DATA CARD #23
(1 of 4)

BRIDGER TESTING LABORATORIES
P.O. Box 161
Warrington, Quincy 70316

SOIL AND GROUNDWATER
MONITORING REPORT

October 1985
Industrial Waste Disposal Systems, Inc.
Warrington, Quincy

I. INTRODUCTION

Objective of Study

The Industrial Disposal Systems, Inc., site near Warrington, Quincy, operates as an industrial waste incinerator facility. During operation, it has been necessary to store barrels of various industrial wastes at a number of locations on the six-acre site. Between 25,000 and 30,000 barrels of industrial waste are currently stored at the site. Several hundred thousand gallons of scrubber sludge and incinerator ash are also on the site. Although the barrels, the sludge, and ash are now in the process of being removed, it is the concern of the QCEQ that the sandy soils at the site may have been contaminated and that the contamination will ultimately enter the near-surface groundwater by the leaching effect of rainfall and melting snow. The soils of the site are primarily sandy with a relatively high permeability.

Bridger Testing Laboratories have been retained by Industrial Disposal Systems, Inc., as engineering consultants for establishing the soil and groundwater monitoring program with the CEQ, to conduct the field and laboratory testing, and to provide this report.

The requirements for a soil and groundwater monitoring program resulted from a court order in the case of State of Quincy vs. Industrial Disposal Systems, Inc., Court File No. 8371, District Court, Third Judicial district, State of Quincy, County of Bear Paw.

Scope of Investigation

Field work, consisting of soil borings and soil sampling and installation of monitoring wells, was performed during June and July 1985. Chemical analyses of soils and water samples from the site were performed during July through September 1985. Chemical analyses of soils and water samples from the site were performed during July through September 1985, and conclusions based on these tests are contained in this report.

II. FIELD AND LABORATORY TESTS

Soil Samples

Nineteen locations on the site were selected as soil sampling locations to represent the site as a whole. The samples were to be chemically analyzed to establish a contamination profile of the site.

Chemical Tests of Soils

All samples to be analyzed were prepared in accordance with the Quincy Commission on Environmental Quality approved leach test procedure. In addition, all samples were subjected to a solvent extraction.

The water leachate was analyzed for concentration of the following substances:

1. Metals: Aluminum, Arsenic, Barium, Boron, Cadmium, Chromium (+6), Copper, Iron, Lead, Magnesium, Manganese, Mercury, Nickel, Selenium, Silicon, Silver, Titanium, and Zinc.

2. Anions: Chlorides, Cyanides, Fluorides, Nitrates, and Sulfates.

3. Other Parameters: Phenolics, C.O.D., pH, Amonia Nitrogen, Oil and Grease, PCB.

The solvent extract was analyzed for concentration of the following: -Aldrin, Chloradane, DDT, Endrin, Heptachlor, Metoxychlor, Mirex, PCH, and Toxaphene.

Chemical analyses for all the substances described above were made by standard procedures.

Groundwater Monitoring Wells

Five groundwater monitoring wells were placed on the site during August 1985 to permit periodic sampling from the shallow groundwater, located about 25 to 30 feet below the surface.

Two groundwater samples were taken from each well to comply with the court order. The first samples were taken on August 9 and the second set on September 5, 1985. The court order directed that if excessive contamination was found in any of the water samples, additional sampling and testing was to be done at regular intervals for the next two years. Excessive contamination was found and continued sampling and testing will be necessary.

Testing of the groundwater samples was done for the same substances as described above for the soil samples and in accordance with standard water analysis methods.

Sludge and Ash Samples

The diked area that once surrounded a 420,000 gallon fuel tank was used for storage of scrubber sludge. The removal of the tank left a cavity in the center of the area about 70 feet in diameter. During the summer of 1985 the drainage ditches along the eastern side of the site were excavated and the sludge stockpiled in the center of the diked area. Incinerator ash from various locations on the site was also stockpiled in the cavity at the center. During August 1985, three samples were taken to represent the sludge and ash in the diked area.

III. DISCUSSION

Sources of Contamination

The operation of Industrial Disposal Systems, Inc., at the Warrington site over the last several years has provided two possible sources of contaminants for the groundwater at the site. These are leakage or spills from the various barrels stored at the site, and scrubber sludge and incinerator ash that had been distributed about the site. In both instances, the leaching action of rain water or melting snow is expected to dissolve the various materials present and eventually percolate downward to the groundwater surface.

There is every indication, however, that there is no water continuity between the sandy top layer and the underlying sandstone which contains the drinking water supply. Although the monitoring wells in the sand indicate fairly high concentration of various metals, such as iron, lead, manganese, and others, the test results for the water supply wells in the sandstone do not indicate any serious contamination.

IV. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the results of the studies, the field and laboratory tests of soil and sludge samples, and on various calculations, the following conclusions have been reached:

1. The data from the various chemical analyses accurately reflect the quantities of various contaminants which are present in the soil samples and capable of being leached by the various leaching procedures used.

2. Considering the total amount of each contaminant and rate of flow of the underlying groundwater, it is unlikely that any of the contaminants will enter the groundwater at harmful level.

3. The total amount of each contaminant contained in all of the stored sludge and ash on the site will not contribute enough additional contaminant to the soil to cause major contamination levels in the groundwater. Contaminants found in the upper sandy layer are not likely to enter the main water supply for the area.

Recommendations

The major source of potential additional contamination of the site is in the stored barrels. Removal of the barrels from the site should be at as rapid a pace as possible and every effort should be made to prevent spillage or leakage onto the ground surface. With removal of the barrels, no additional source of contaminants will be available at the site. As required by the court order, additional monitoring of the groundwater monitoring wells must be continued for a period of at least two years.

The scrubber sludge and incinerator ash presently stored within the diked area may be left in place or may be spread over the surface of the site. If it is left in place, the rate of leaching will be much lower than if it is spread out. If it is placed over the surface of the site, it should then be thoroughly mixed with the upper one or two feet of sand and well compacted.

Respectfully submitted,

Dr. S.M. Bridger

DATA CARD #24

Quincy Commission
on Environmental Quality
Lakeville, Quincy 71740

ESTIMATED COSTS FOR CLEAN-UP

AT INDUSTRIAL DISPOSAL SYSTEMS, INC.

1. $30 per barrel for removal, with approximately 28,000 barrels on site in August 1985.
2. $300,000-400,000 for sludge removal and disposal.
3. $250,000 for excavation of contaminated soils and disposal.

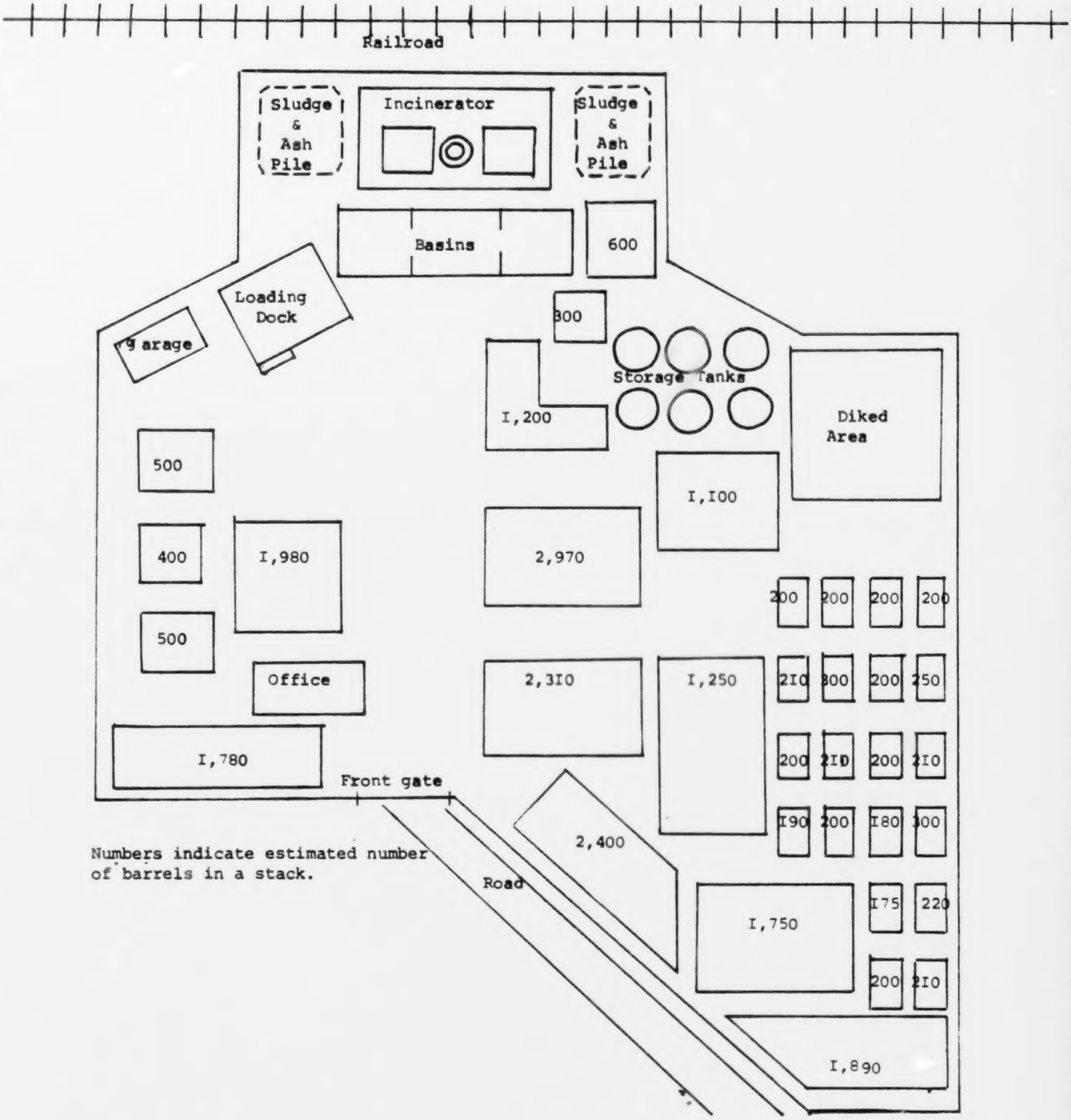
DATA CARD #25

ESTIMATED COSTS FOR REPAIRS
AND MODIFICATIONS AT IDSI TO MEET STATE REQUIREMENTS

	DESCRIPTION		COST
1.	Improve safety of storage tanks		24,300
2.	Build new tanks for additional storage		31,215
3.	Improve safety of settling basins		27,128
4.	Build a new waste cell		75,024
5.	Install automatic safety equipment on incinerators		8,109
6.	Repair an existing water well		4,048
7.	Improve laboratory and personnel facilities		31,264
8.	Rebuild unloading area and dock		16,313
9.	Install fire protection equipment		6,278
10.	Remodel control room and offices		87,623
11.	Install a material handling system		15,956
12.	Build a dike around storage tanks		5,190
13.	Install safety devices on tanks		15,052
14.	Install new machinery		7,951
15.	Build a tank for storing caustics		4,086
16.	Install pumps		1,563
17.	Replace the existing smoke stack		87,556
18.	Electrical service and lighting		17,100
19.	Install signs and labeling codes		410
20	Fire protection for large storage tank		3,500
		Subtotal	$469,666
21.	Engineering Engineering costs add approximately 12%		
		Grand Total	$526,026

DATA CARD #26

Site Diagram of Industrial Disposal Systems, Inc.
Warrington, Quincy


Railroad
Sludge & Ash Pile
Incinerator
Sludge & Ash Pile
Basins
600
Loading Dock
Garage
300
Storage Tanks
I,200
Diked Area
500
I,100
400
I,980
2,970
200
200
200
200
500
Office
2,3I0
I,250
2I0
300
200
250
I,780
200
2I0
200
2I0
Front gate
I90
200
I80
300
2,400
Road
I75
220
I,750
200
2I0
I,890

Numbers indicate estimated number of barrels in a stack.

BEST COPY AVAILABLE

DATA CARD #27

INDUSTRIAL DISPOSAL
SYSTEMS, INC.
P.O. Box 481
Warrington, Quincy 71826
Phone (888) 461-3721

November 1, 1985

ATTENTION: PLANT MANAGERS

Recently several requests were made of us by state regulatory agencies. In order to comply with the most immediate request we will need your cooperation.

Barrels are entering our facility without the appropriate hazard warning labels. We are now required by the Quincy State Fire Marshall that all barrels containing toxic and hazardous wastes shipped to our facility be labeled in accordance with Department of Transportation regulations. All fire fighters are trained to recognize this standard labeling system and to react properly in case of emergency. Therefore, all barrels received at our facility must be properly labeled.

The state's requirement is exacting. All barrels must be properly labeled for shipment to our plant. As of December 1, 1985, any shipments received by IDSI not properly labeled will be assessed a surcharge of $1.00 per barrel or the shipment will be returned.

Please make sure that your staff is aware of these requirements to reduce your costs. There are many changes in regulations governing toxic and hazardous wastes.

We appreciate your past business and cooperation and look forward to serving your needs in the future.

Sincerely,

Barton Stone
President

DATA CARD #28
(1 of 2)

IDSI
INDUSTRIAL DISPOSAL
SYSTEMS, INC.
P.O. Box 481
Warrington, Quincy 71826
Phone (888) 461-3721

November 5, 1985

Dear Customer:

Incineration is the most effective known method of destruction of organic materials; however, even after the total destruction of these organics, traces of some inorganic materials, particularly heavy metals, still occur in our ash and sludge. In the past, our permit allowed us to dispose of this ash and sludge in an approved landfill. This is no longer the case. The Quincy Commission on Environmental Quality will not allow disposal of the ash and sludge in Quincy. Furthermore, the CEQ is strongly urging us to reduce the number of barrels at our Warrington site. We are currently negotiating with two out-of-state companies to accept our ash and sludge and some of the barrels.

In an effort to keep costs to our customers at an acceptable level, IDSI will in the future use incineration, chemical landfill, and chemical fixation as methods of disposal.

Upon completion of plant improvements, a new series of tests will be conducted on our stack to determine the particulate emission to ensure continued compliance with all state and federal laws. With these improvements, we will be better able to serve our customers at the most environmentally acceptable level possible under existing state and federal laws.

If more information is desired concerning the foregoing, please advise our office. It is in our mutual best interest to allow us to train the responsible individual in your company in the proper handling and labeling of your chemical wastes.

The following improvements are being made to the Warrington plant to ensure compliance with all laws and to increase productivity and efficiency:

A. Completion of the #2 side of the plant (which has not been in operation recently). This will increase our production capacity by 100 percent.

B. Refurbish the #1 side to enable maximum burning efficiency.

C. Purchase of a 120-foot stack to replace the existing 60-foot stack to counteract the problem of thermal inversion.

D. Installation of a sludge drying system.

E. Lining of the entire combustion chamber on both sides to lengthen the residence time of materials to ensure total combustion.

F. Purchase of continuously recording meters to ensure that high temperatures are maintained in the combustion chambers.

We appreciate your continuing business and support during this period when our company has suffered from adverse publicity.

Sincerely,

Barton Stone
President

DATA CARD #29
(1 of 4)

Quincy Commission
on Environmental Quality
Lakeville, Quincy 71740

STIPULATION AGREEMENT

In the Matter of Alleged
Violation of Quincy Statutes
and Regulations by
Industrial Disposal Systems, Inc.
P.O. Box 481
Warrington, Quincy

ROUGH DRAFT FOR DISCUSSION

A. RECITALS

1. PARTIES. The parties to this Agreement are the Quincy Commission on Environmental Quality and Industrial Disposal Systems, Inc., hereinafter the Company.

2. COMPANY OPERATION. The Company is a Quincy corporation engaged in the transportation, storage, and incineration of waste chemical within the State of Quincy.

3. COMMISSION AUTHORITY. The Commission is charged with overall power and duties to administer and enforce all laws, regulations, and agreements relating to the prevention and control of water, air, and solid waste pollution. This authority is specifically described in Quincy Statutes, Chapters 115 and 116, 1980.

B. AGREEMENT

NOW, THEREFORE, for the purpose of achieving compliance with state laws, regulations, policies, and criteria relating to the prevention of pollution of the State of Quincy, it is hereby agreed and stipulated that Industrial Disposal Systems, Inc., shall undertake and complete the following program:

1. NOTIFICATION. The Company shall notify the Agency immediately of the discharge of any substance or material under its control which, if not recovered, may cause pollution of the waters of the state.

2. RECOVERY AND CLEANUP. The Company shall recover any discharged substance or material as rapidly and as thoroughly as possible and take immediately such other action as may be reasonably possible to minimize pollution of waters of the state caused thereby.

3. PROCEDURES. The Company shall prepare and implement procedures enabling it to react, as required by this Stipulation Agreement, to prevent pollution of the waters of the state. Such procedures shall include:

a. Recovery and Cleanup Capability. The company shall provide manpower, equipment, and materials to be available for dispatch to all points within the state at any time, whether or not during normal business hours or holidays and weekends, for the purposes of recovery and cleanup of spilled material under Company control under the terms of this Stipulation Agreement. The Company shall remain liable to the state for any failure to comply with the terms of this Stipulation Agreement.

b. Authority To Commit Company Resources. The Company shall delegate the authority to commit the manpower, equipment, materials, and money necessary to fully comply with the terms of this Stipulation Agreement to such employees or agents as necessary to provide that such authority is always vested in someone who is in immediate contact with the situation creating the pollution threat to the waters of the state.

c. Preparation of Instructions. The Company shall prepare detailed instructions outlining the procedures to be followed to prevent pollution of the waters of the state from materials handled by the Company. Such instructions shall include immediate recovery procedures, names and telephone numbers of persons and agencies to contact, thorough cleanup procedures, and other information necessary to insure full compliance with the terms of this Stipulation Agreement.

d. Distribution of Instructions. The Company shall distribute a copy of the instructions to every driver, employee, or agent who may observe a pollution threat to the waters of the state. The Company shall place and maintain a copy of such instructions in every vehicle under their control and at their Warrington facility.

e. Implementation. By December 1, 1985, the Company shall submit satisfactory evidence that the Company has complied with and implemented the procedures outlined in this agreement.

4. LIQUID STORAGE IMPROVEMENTS TO ACHIEVE COMPLIANCE WITH PERMIT.

a. Plans and Specifications. By January 15, 1986, the Company shall submit to the Agency satisfactory plans and specifications for upgrading the site to meet the conditions of issued permit number 8511.

b. Inventory Reduction. By January 1, 1986, the Company shall submit a satisfactory plan of action to the Agency for the reduction of its inventory of 55-gallon drums to 5,000 or less. This plan shall include as a minimum an engineering report reviewing the plant's shall include as a minimum in the barrels as certified by a registered professional engineer. The company shall achieve and stay within the 5000 drum limitation by and from January 1, 1987.

5. COMPANY REMEDIAL ACTION. The Company shall begin any reasonable and feasible remedial action or measure that is required to monitor, eliminate, or abate any water pollution or contamination threats found to be existing at the Company's Warrington site. The Company shall begin and subsequently complete the required remedial action or measure within a reasonable period of time, but no later than January 1, 1987. Beginning August 1986, the Company shall monitor for and submit a monthly report reflecting the condition of the underground waters in the vicinity of the Company's Warrington site. The monitoring report must be submitted within 15 days after the end of each month.

If the Company, after monitoring underground waters for at least six months, determines that the underground waters are being maintained at their natural quality, the Company may request that the monitoring requirements be reduced or eliminated.

6. ANALYSIS OF INCINERATOR ASH AND SCRUBBER SLUDGE. The Company shall complete a chemical analysis of representative samples of incinerator ash and scrubber sludge. Preview of this chemical analysis will determine if either of these waste sources may be classified as hazardous waste.

7. CONTINUOUS RECORDING OF INCINERATION TEMPERATURES. The Company shall install a continuously recording meter and shall record primary and secondary combustion chamber temperatures in the incinerator.

8. PROPER DISPOSAL OF WASTE GENERATED BY COMPANY. The Company shall implement any reasonable and feasible remedial action or measure required by the Commission which is necessary to properly dispose of hazardous waste generated by the Company.

9. STACK PLANS. By April 1986, the Company shall install a new stack at the Warrington facility. By April 15, 1986, the Company shall initiate satisfactory stack emission testing of the new stack to determine compliance with air pollution control permits.

10. COMPANY CONTROL OF ODORS. The Company shall operate its facility at all times in a manner which will not allow emissions into the air of odorous air contaminants. If the Company violates state regulation at any time after the effective date of this agreement they shall pay into the Treasury of the State of Quincy fifteen hundred dollars ($1,500) for each day on which a violation occurs.

The Company further agrees to voluntarily cease operation whenever a complaint is made about odorous emissions and the Commission Director confirms that such odorous emissions are causing a nuisance. The Company shall not resume operation until authorized by the Commission Director.

11. PERFORMANCE BOND. The Company shall obtain a performance bond for $500,000 for its Warrington facility, in order to idemnify the Agency for damages and costs to the State for cleanup, recovery, or abatement of any past, present, or future threat of pollution to surface or underground waters or to the air which would result from the Company's failure to comply with conditions of this Stipulation Agreement.

R.M. WODNIK

At 32 you are one of the younger division heads at the Quincy Commission on Environmental Quality (CEQ), where you are chief of the Air Quality Division.

Because many complaints have been registered against Industrial Disposal Systems, Inc. (IDSI), in the past, you are very familiar with this case. The company disposes of waste chemicals--acids, oils, plastics, solvents, and so on--by incineration. Burning these wastes creates very dark, dense smoke. Scrubbers installed in the stacks of the incinerators can remove a major part of the smoke's particulate content. Use of platinum fan blades would also help decrease the pollution from the incinerators.

However, IDSI has a history of using cheap equipment. Their scrubbers have broken down several times. They have also refused to install the expensive platinum fan blades, using black steel fan blades instead. The chemicals being burned corrode these steel blades rapidly. As a result, IDSI often produces very heavy, dark smoke. This smoke has a very offensive odor and contains many particulates. Residents of Warrington have complained repeatedly about this continuing smoke problem. The company has clearly violated its air pollution permit.

The company could be taken to court and fined, but you believe it is important to prevent further violations. You would like to see a stipulation agreement between the CEQ and IDSI. This agreement should include the following points:

--The company should install proper equipment which will not burn out rapidly.

--The company should not burn wastes when its equipment is not operating properly. It should make the necessary repairs before resuming incineration.

--The company's equipment should be periodically inspected to ensure that it is operating properly.

--The company should accept for disposal only those wastes which it can properly incinerate.

A.A. STAVROS

You are a 39-year-old employee of the Water Quality Division of the Quincy Commission on Environmental Quality (CEQ). On several occasions you have visited the Industrial Disposal Systems, Inc. (IDSI), site. The buildup of barrels of waste is very disturbing to you. If these barrels remain outdoors for any length of time, they may begin to corrode. Corrosion will allow the chemicals in the barrels to leak out; this could contaminate the water supply near IDSI.

The number of barrels now at the IDSI site far exceeds the number allowed under the permit issued by the CEQ. The company is thus in violation of its permit. Furthermore, the barrels are not stored properly. They are simply stacked on wooden pallets. They should be stored in a diked area which would contain leaks and spills so that chemical wastes would not seep into the ground and contaminate the water supply. To ensure that such contamination has not already begun, the company should test the groundwater at regular intervals--maybe once every two weeks.

You believe that the best way to handle the problem at IDSI is to get the company to clean up the site. Closing the company will not ensure that such cleanup will take place, but a stipulation agreement between the company and the CEQ will. Here are the points you believe should be included in a stipulation agreement:

--The groundwater near IDSI should be tested for contamination. If such contamination exists, IDSI should be responsible for restoring the quality of the groundwater supply.

--The barrel inventory should be reduced to fewer than 5,000 barrels. All leaking and/or corroded barrels should be removed from the site immediately.

--A plan to prevent future groundwater contamination by leaking wastes should be developed.

W.C. RADSEK

You are a 45-year-old bookkeeper who worked for Industial Disposal Systems, Inc. (IDSI), for three years. You came to know and like many of the people who currently work at IDSI. If the company were forced to close, these people would lose their jobs. Closing IDSI would, in your opinion, be too drastic an action. You know there are problems with the company, but these problems can be taken care of satisfactorily.

One often-discussed problem is that IDSI has accepted wastes from other companies which it cannot properly incinerate. You know that this is true, but it is the result of company policy. Sometimes the people at the gate responsible for accepting shipments of waste from other companies are not properly trained. They are not sure which wastes to accept and which to reject, so they end up accepting the entire shipment. To correct this problem, the company should be required to train all employees to recognize which waste materials can be processed by IDSI and which cannot.

This problem and several others can best be handled by negotiating an agreement between IDSI and the Quincy Commission on Environmental Quality. Such an agreement should require full training for IDSI personnel, installation of proper air pollution control equipment, and a step-by-step plan to reduce the number of barrels of waste currently at the Warrington site.

JOHN DWYER

You are the 57-year-old president of a small paint company located in northern Quincy. Your company has been a customer of Industrial Disposal Systems, Inc. (IDSI), for six years. The IDSI issue is of great concern to you.

Several companies in the state of Quincy create waste products as a result of the manufacturing processes they use. Many of these wastes are hazardous and would seriously affect the environment if not disposed of properly. In some states companies have dumped their wastes in lakes and streams or along the sides of highways. You have even heard of tank trucks driving through city alleys in the rain with their valves open. It takes about ten minutes to empty a 6,000-gallon tank truck that way, and it costs almost nothing. You don't want to see this kind of thing happening in Quincy.

IDSI provides the most effective and environmentally safe method of disposal--incineration. The CEQ should seek ways to help IDSI operate at its most efficient level. You know this means that the company will have to install new and expensive equipment, but you believe the company will be able to pay for this equipment with increased profits. After all, IDSI's business should get better as transportation of wastes to out-of-state disposal sites becomes more expensive.

In addition, Warrington and Bear Paw County will lose income if IDSI is forced out of business. Both the city and county receive tax money from the company. Many of the company employees live in Warrington or other parts of the county. They pay taxes and spend money in the stores and businesses nearby.

The CEQ should negotiate an agreement with the company covering these points:

--IDSI should install proper air pollution control equipment.

--The company should develop a plan to ensure that the wastes in the barrels on the site do not contaminate Warrington's groundwater supply.

--The company should post a bond of several thousand dollars; the CEQ could use this money to clean up the site if IDSI does not meet the terms of the agreement.

RONALD ZAWARSKI

You are a 53-year-old chemical engineer employed by the U.S. Environmental Protection Agency (EPA). The EPA has not taken any official action in the Industrial Disposal Systems, Inc. (IDSI), case; however, Section 7003 of the Resource Conservation and Recovery Act may allow the EPA to take action. That section authorizes the EPA to take enforcement action against the owner of a hazardous waste site if the site is presenting an "imminent and substantial danger to human health or the environment."

You believe that there is a potential danger in the IDSI case, but this danger can be avoided if the Quincy Commission on Environmental Quality (CEQ) takes effective action now.

Such action should include the negotiation of a stipulation agreement between the CEQ and IDSI. The agreement should require IDSI to:

--Install proper air pollution control equipment.

--Stop accepting wastes that it cannot incinerate with its equipment.

--Submit a plan for the reduction of the number of barrels stored at the Warrington site.

--Submit a plan for testing groundwater supplies for contamination.

--Conduct tests of its sludge and seek to determine if leaking of heavy metals or hazardous chemicals is occurring.

--Post a bond of several thousand dollars which may be used to pay for cleanup if the company does not meet the terms of the agreement.

You think that such a stipulation agreement will help both the community and the company. The company will be allowed to continue operation, and you believe its business will improve. The community will not lose a major tax-paying business. Furthermore, the air pollution problem will be improved with the installation of the new equipment, and the more serious long-range problems of contamination from wastes in the barrels and the ash and sludge will be avoided by the use of efficient incineration and disposal techniques.

JOYCE RUIZ

You are a 74-year-old lifelong resident of Warrington looking forward to living out your life in that town. This Industrial Disposal Systems, Inc. (IDSI), problem really has you worried. You wonder why a thing like this has to happen in a nice town like Warrington.

The smoke and soot from the IDSI smokestacks have most of your friends and neighbors worried. They want to close the company to stop the air pollution. You would like to see the air pollution stopped too, but you fear that the problems which might arise if the company is closed and the barrels are left at the site might be worse.

Burying the wastes doesn't seem to be the best solution. Look at the case of the Love Canal in Upstate New York. An elementary school and a housing project were built on land that covered an old chemical dump. Dumping at that site was stopped 25 years ago, and the dump was sealed. It was then covered with soil, and the houses and school were built a few years later. Earlier this year chemicals began leaking out of the dump. Pools of chemicals actually formed in some yards and basements. Because of the contamination, more than 230 families had to permanently leave their homes. The state of New York was forced to pay for the evacuation. Now, the state is paying for the cleanup.

You are afraid that something like this might happen in Warrington if nothing is done to take care of the barrels now stored at IDSI. Burning these wastes seems to be the safest way of disposing of them. You would therefore like to see an agreement between the state and the company. The agreement would allow the company to continue to operate if it used better equipment to prevent serious air pollution. It would also require IDSI to test the water in nearby wells at set time intervals to be sure that they are not contaminated.

R.B. HOSAKAWA

You have worked in the Solid Waste Division of the Quincy Commission on Environmental Quality (CEQ) for the past five years. During this time you have seen many serious pollution problems, but the Industrial Disposal Systems, Inc. (IDSI), problem is one of the most serious you have ever encountered. Many people, especially Warrington residents, complain about the smoke and particles from the incineration of wastes, but you see this as only a minor, short-term problem. The more serious problems are long-term: (1) What can be done to dispose of the waste in the 20-30,000 barrels now stored at the IDSI site? (2) What should be done with the sludge that remains after wastes have been burned? (3) What should be done with the ash that remains after wastes have been burned?

The sludge and ash are currently dumped on the IDSI Site. No one is quite sure what the chemical composition of the sludge and ash is. Serious contamination could result if chemicals were washed out of the sludge and ash by rain or snow and then seeped into the groundwater supply.

In your opinion the best way to handle the IDSI problem is to negotiate a stipulation agreement with the company. That agreement should include the following points:

--The company should conduct tests on the sludge and ash to determine if they include hazardous waste.

--The company should develop a plan for proper disposal of its sludge and ash.

--The company should not be allowed to abandon its Warrington plant unless it first disposes of all wastes currently at the site.

--The company should be required to deposit money in a bank account. This money could be used to finance cleanup if the company does not meet the terms of the agreement.

C.A. BURICH

You are an attorney on the staff of the Quincy state attorney general's office. For the past three years your assignment has been to assist the Commission on Environmental Quality (CEQ) in settling environmental disputes among businesses, state agencies, and other levels of government. In the past you have had some success in bringing court action against companies that violate pollution regulations. In many of these cases companies were charged fines for their violations. Such cases, however, take a great deal of time and preparation, both on your part and on the part of the staff of the CEQ.

You believe that because of the excessive amount of work and costs required, court action should be used only as a last resort. Closing Industrial Disposal Systems, Inc. (IDSI), will probably require court action. If the CEQ and IDSI were to negotiate a stipulation agreement, the problem could be resolved more satisfactorily. The agreement would outline steps which the commission staff believes should be taken to resolve the problems at IDSI. It would also outline penalties the company would face if it did not meet the terms of the agreement.

There are several reasons for negotiating a stipulation agreement. First, you believe it will save time and effort. Second, although it is possible, through court action and other techniques, to punish violators of environmental regulations, you believe such punishment serves little purpose unless it forces the violators to comply with the regulations. A stipulation agreement can tie fines to specific violations. Third, the major goal of the CEQ is to ensure that the environment is protected. Closing the plant will only stop the air pollution; the barrels of waste will remain. This could cause a serious problem in years to come. The stipulation agreement will insure that the area is cleaned up to avoid such long-range problems.

The company would sign the agreement in the same way it would sign a contract. If the company refuses to negotiate a stipulation agreement, then court action may be necessary.

J.S. KIRCHER

You are a 48-year-old Bear Paw County commissioner. You are currently serving your second term on the commission, and you are generally recognized as one of its most outspoken environmentalists. Residents of the county have frequently called and written to you about the conditions at Industrial Disposal Systems, Inc. (IDSI). Recently you received several petitions signed by more than 5,000 people protesting the smoke and potential fire hazard at IDSI. These residents want to see the company closed.

You believe these residents are right: IDSI should not be allowed to continue to operate in Bear Paw County. The company has a long record of not living up to its agreements. On several occasions company officials agreed to take steps to decrease the pollution from its operation, yet they never did everything they promised. Sometimes they installed new equipment, but of poorer quality than was called for. At other times, they didn't do anything. As a matter of fact, the company has already signed a stipulation agreement with the county, but it has not lived up to that agreement.

You don't believe that the people of the county should have to live with the constant health hazard presented by IDSI. The smoke it produces when incinerating waste is dark and odorous. The chemical wastes which are stored in barrels also represent a hazard. If the barrels leak or corrode, wastes may contaminate the groundwater near the IDSI site. The ash and sludge at the site might also lead to contamination of the water supply.

The plant should be closed and the barrels removed as soon as possible.

MARIA ALIFANO

You are a 34-year-old resident of Warrington. After living in the eastern United States most of your lives, you and your husband decided to move to a smaller community in the central part of the country. You chose Warrington because it was a medium-sized town that was known for its "clean" industries--electronics, medical technology, pharmaceuticals, and so on. Now, look what's happening!

The fire at Industrial Disposal Systems, Inc. (IDSI), really frightened you. The smoke from that fire was the darkest you have ever seen, and people told you that the heat from the fire could be felt blocks away. Now there are even more barrels at the IDSI site. What would happen if another fire were to break out?

You think the decision to be made by the Commission on Environmental Quality (CEQ) is an easy one--close IDSI. The plant pollutes the air in Warrington. The 20-30,000 barrels of waste at the site are a constant fire hazard. And IDSI is an eyesore; all those barrels are ugly.

As a matter of fact, you don't believe that there is any benefit to Warrington or to Bear Paw County in having IDSI located there. The company doesn't employ enough people to make a difference in the community's economy. And the taxes paid to the city and county certainly don't make up for all the problems. Just keeping an eye on the company to make sure that it is not breaking regulations is costing the city and county plenty.

PATRICIA YUNG

You are a 32-year-old member of the Warrington City Council. This is your first term on the council, and you are concerned about pleasing those who voted for you. The Industrial Disposal Systems, Inc. (IDSI), problem is an extremely important local issue. Everything indicates that the voters want IDSI closed as quickly as possible, and you agree with them.

You believe that working out a stipulation agreement between the Quincy Commission on Environmental Quality (CEQ) and IDSI is an unrealistic solution. How would the agreement be enforced? The company could sign the agreement and then go ahead and do as it pleases. What would happen then? Who would check to make sure the company lived up to the agreement? The CEQ has not kept a close eye on IDSI's operation, somehow allowing the company to operate even when it was violating the CEQ permits. The city cannot afford to hire someone to visit IDSI everyday to make sure it doesn't violate the stipulation agreement, but that is what would be necessary.

The CEQ should close IDSI immediately. Court action should then be taken to fine the company a large enough sum to cover the costs of cleaning up the site. You believe that such cleanup may cost as much as $1 million. IDSI should also be fined for past violations of state, county, and city air, water, and solid-waste regulations.

KEVIN ALLEN

You are a 39-year-old fire inspector for Bear Paw County. For years you have been concerned about Industrial Disposal Systems, Inc. (IDSI), and now you feel there is enough public pressure to get the company closed.

Even before the fire at IDSI, you had received many complaints about the company. Residents of Warrington repeatedly complained about foul, sickening odors. The smoke from the plant was so bad that you were told to inspect the IDSI incinerators. You found that the incinerators were improperly run and poorly maintained. The smokestacks actually had holes in them which made it possible for wastes to escape from the stacks before being fully incinerated.

After the fire at IDSI, you inspected the company site in Warrington. What you saw was terrible. The barrels of waste were piled haphazardly on the bare ground. Some of the barrels were leaking onto the ground, and trenches and pits had been dug to catch the drainage. No special effort was being made to prevent this leakage from seeping into the ground. The ash and sludge from the incinerator were simply dumped on the site. It was so bad that you saw company employees in hip boots pumping sludge.

The fire hazard at IDSI is made even worse by the fact that no one in your department knows exactly what is in the 20-30,000 barrels at the site. The president of IDSI claims to have information on the barrels' contents, but he has not given that information to your department. How can you be expected to be prepared to fight a fire if you do not know what will be burning, whether it will be explosive, or whether the smoke will be poisonous?

The Commission on Environmental Quality (CEQ) should close IDSI immediately. You know that there is no sanitary landfill in Quincy that can legally accept hazardous chemical waste, but one of the state's largest manufacturing companies does operate a private incinerator. CEQ may be able to contract with that company to dispose of the waste currently stored at the IDSI Warrington site. Of course, the CEQ would have to take legal action against IDSI to cover the costs of this disposal.

A.M. WILLETTE

You are a 36-year-old public environmental health officer for Bear Paw County. As part of your job, you have made several inspections of the Industrial Disposal Systems, Inc. (IDSI), site in Warrington. During these inspections you found considerable evidence of incompetent handling of chemical wastes. The barrels of waste are piled haphazardly on muddy ground. You know that the subsoil around the IDSI site is sandy, which means that liquids can pass through it easily. Since many of the barrels are damaged and leaking, there is a high potential that the groundwater under the IDSI site has already been contaminated.

You also found that some of the barrels are marked, listing their contents; however, many markings have worn off so that it is difficult to determine the contents of each barrel. You therefore cannot predict what kind of contamination might result from leakage. You do, however, know that many barrels contain paint, chemicals, oils, or acids.

Another source of potential contamination at the site is the ash and sludge from the incinerators. These contain heavy metals and other materials which may be drawn into the soil by rain and melting snow. This could also lead to contamination of water supplies.

Of course, the most apparent health hazard comes from the incineration itself. IDSI's equipment is poorly suited for burning the kinds of chemicals accepted by the company. Because this equipment is of poor quality and in need of repair, the chemical wastes are not efficiently and completely incinerated. Heavy, foul-smelling smoke is the result.

You want IDSI closed, but you want the long-term health hazard removed as well. The Commission on Environmental Quality should take court action to prevent IDSI from operating its incinerators and to force the company to:

--Remove all barrels of waste from the Warrington site, beginning with those barrels which are leaking, damaged, or corroded.

--Test groundwater supplies for possible contamination.

--Dispose of the ash and sludge by removing it from the Warrington site.

--Take necessary steps to reverse any negative environmental effects resulting from its operation.

ARTHUR O'REILLY

You are a 51-year-old resident of Warrington who is very disturbed about the Industrial Disposal Systems, Inc. (IDSI), problem. For more than 25 years you have lived and worked painting houses in this community. After IDSI moved in, you began having serious problems. Several times you have been in the middle of painting a house when the wind shifted and brought smoke from IDSI in your direction. Ashes, soot, and other particles in this smoke settled on the wet paint and destroyed your work. You cannot afford to redo work! Your time is valuable.

The smoke not only interferes with your work, it is a general nuisance as well. It makes the town look dirty, it smells, it settles on houses and other buildings, and you believe that it has even affected your garden. You also are unable to hang clothes outside on the line to dry. They end up dirtier than they were before they were washed.

You want to see IDSI closed as soon as possible, and you don't care what happens to the barrels now on the company site. As a matter of fact, you aren't sure that there is any need to be worried about those barrels. After all, what can happen? The leaking chemicals will only soak into the ground. Nobody is going to farm that land, and no streams run through it. The worst that can happen is that the ground at the site will be ruined.

J.D. STEIGER

You are the 45-year-old Bear Paw County district attorney. This is your fourth year in that job. You believe that doing a good job in helping to resolve the Industrial Disposal Systems, Inc. (IDSI), issue will help your career greatly. As a matter of fact, if the Quincy Commission on Environmental Quality (CEQ) allows IDSI to continue its operation under any conditions, you will recommend that the county take court action against IDSI to close the plant.

You believe that the CEQ has given IDSI too many chances. Even CEQ staff members recognize that IDSI has violated many state environmental regulations. CEQ could easily prove that IDSI has violated permits and broken laws. Why doesn't the CEQ prosecute the company for these violations?

Furthermore, the company has not acted in good faith in its dealings with Bear Paw County. The county required IDSI to apply for and receive an operating permit. The company obtained permits from the CEQ and went ahead with its operation without getting a permit from the county. Some time later the company and the county signed a stipulation agreement calling for IDSI to clean up its Warrington site and install equipment to reduce the air pollution from its incinerators. The company has not lived up to that agreement.

You would like to see the CEQ take court action to close the IDSI plant. The court should impose fines on the company for past violations. This fine money could be used to pay for disposal of the barrels and ash and sludge at the IDSI site.

H.S. INGVOLD

You are a 39-year-old planning and zoning coordinator for Bear Paw County. The Industrial Disposal Systems, Inc. (IDSI), case is of great concern to you.

You believe that IDSI is giving Warrington and Bear Paw County a bad image. The town has always prided itself on its pleasant living conditions and healthy environment. Its leaders have always tried to attract "clean" industries--for example, electronics manufacturers--to Warrington. Now the publicity about the problems with IDSI may frighten new development away from the town.

Why should the people of Warrington put up with IDSI in their community? No one wants to live near a disposal site for hazardous wastes. The federal government recently made a grant to the state to help identify a 200-acre site for disposal of hazardous chemical wastes. A committee to help select the site was appointed by the state legislature. The committee has considered three possible sites, but it has been forced by public opinion to reject all three. The committee held public hearings to discuss the plan with residents near each site. At each meeting, crowds of people came to oppose the location of a disposal facility in their community.

You want to see the Commission on Environmental Quality (CEQ) close the IDSI facility in Warrington. Of course, someone will have to pay for the cleanup at the site, but you believe the state must accept responsibility for financing that effort.

BARTON STONE

You are the 52-year-old president of Industrial Disposal Systems, Inc. (IDSI). You feel that you have been harassed about your company's operation ever since you opened your Warrington site. Certainly, IDSI has had some problems, but you believe that things can get better if the Quincy Commission on Environmental Quality (CEQ) will let you conduct your business in the way you want to conduct it.

After all, IDSI provides an important service to Bear Paw County and to the entire state of Quincy. It is the only company which disposes of chemical wastes coming from the many manufacturing firms in the state. Someone must provide this service; companies cannot simply dump their wastes in their backyards.

But CEQ interference is hurting your company in several ways. First, IDSI is faced with too many regulations and must apply for too many permits. The city of Warrington wants its say about what the company should do and how it should operate. Bear Paw County also wants to put restrictions on your company. And the state wants you to follow its regulations. All these different regulations are confusing, and the permits and licenses IDSI is required to have are very expensive. You are willing to abide by the rules, but one set of rules should be enough.

Second, the continued action against IDSI has created a great deal of bad publicity that hurts the company's image and profits. Already, some of your customers are threatening to cancel their contracts. If this should happen, the company would have to cut back its operation, and it would be unable to buy the proper equipment to ensure clean and efficient incineration of its customers' waste products.

Third, the bad publicity has made securing credit difficult. This means that it is difficult for IDSI to operate in a manner which will allow the company to reduce the number of barrels currently stored at the Warrington site.

Fourth, the CEQ does not offer any assistance to IDSI in meeting the state's regulations. The company is forced to employ expensive outside consultants to help in planning.

You believe that the company should be allowed to operate without interference for two years. By that time IDSI's profits and business will have improved enough to pay for new and more efficient equipment. The company will continue to be the only chemical disposal site in Quincy, and its operation will cause fewer problems as new equipment and techniques are incorporated into its operation.

E.W. MELEK

You are a 39-year-old attorney representing Industrial Disposal Systems, Inc. (IDSI). You strongly believe that IDSI is being treated unfairly.

The disposal of chemical wastes is one of the most serious environmental problems facing our nation. A recent estimate claimed that more than 70 billion pounds of hazardous waste are produced in this country each year. Yet only about 10 percent of these wastes are disposed of safely. A great deal of chemical waste is actually disposed of illegally.

IDSI was created to help solve part of this national waste disposal problem. The company employs the most modern and scientifically effective techniques. Most experts agree that incineration is a better means of disposal than dumping. But the company is not being allowed to operate at peak efficiency. Regulations from Warrington, Bear Paw County, and the state are confusing. Many of the regulations are not clearly stated, and regulations from one level of government sometimes conflict with those from another level of government. It has reached the point where IDSI no longer knows whom to obey.

The company has tried to meet all the different regulations and to obtain the necessary permits for operation. This requires considerable time and expense. Waiting for permits often means that the company must restrict its operation in some ways. These repeated delays are partly responsible for the buildup of the large number of barrels at the Warrington site.

IDSI should be allowed to operate its disposal facility in the manner which it determines to be most effective. If this course of action is followed, the company can dispose of most of the wastes currently stored at its site. This will remove the long-term problem of possible groundwater contamination.

K.V. RIDLEY

You are the 57-year-old manager of a food processing plant. Much of the chemical waste from the processing at your plant is shipped to Industrial Disposal Systems, Inc. (IDSI), for disposal. IDSI charges your company less than you would have to pay to ship the wastes out of state for burial. Furthermore, your company's board of directors has made it a company policy to employ the safest disposal techniques available. They are convinced that incineration leads to the least harmful environmental impact.

Another reason for disposal through incineration is that it helps to maintain the secrecy of your company's chemical formulas. You produce some unique products with special formulas, and you do not want your competitors to discover these formulas. Your competitors could determine these formulas from an analysis of the waste products, but IDSI has guaranteed that they will not disclose information about the contents of barrels of waste from your company.

You feel that closing IDSI will have a negative impact on the state's environment. Since there is no other legal disposal site available in the state and the cost of transportation to sites in other states is skyrocketing, some unscrupulous businesses may dump their wastes illegally. Certainly, this would be a serious problem more difficult to control than the operation at IDSI.

You believe that IDSI has tried to operate its disposal facility properly. The Commission on Environmental Quality (CEQ) should allow the company to operate without interference for a period of two years, with the understanding that after that time all permits and licenses will be carefully reviewed. If the company has not properly disposed of the barrels, sludge, and ash and has not installed appropriate air pollution control equipment, the CEQ can then take appropriate action.

Role Card BG-20

D.P. SORBO

You are a 37-year-old industrial consultant. You were hired by Industrial Disposal Systems, Inc. (IDSI), to evaluate the company's operation and to recommend ways in which it can become more effective. You believe that IDSI provides an important service for the state of Quincy.

After a careful examination of the conditions at the IDSI site in Warrington, you have come to these conclusions:

--The smoke and air pollution problem is the easiest to handle. New equipment will decrease this problem significantly.

--If the Commission on Environmental Quality (CEQ) forces IDSI to close, they will be faced with the long-term problem of what to do with the waste in the 20-30,000 barrels stored on the Warrington site.

--The company can incinerate most of the wastes contained in the barrels.

--Safe techniques for disposing of the other wastes do exist. The waste material can be encased in thick clay vaults or sealed in rust-proof containers. Dumping grounds can be protected from water by sealing them off with alternating layers of clay and plastic.

--IDSI will need additional income to pay for new equipment and other disposal techniques.

--If the company becomes more effective in disposing of wastes safely, its business and profits will increase.

--Continued interference from the CEQ and other governmental agencies will have a negative effect on the company's profits.

Since cleaning up the Warrington site and improving its equipment are to the company's financial benefit, you believe that the CEQ should allow the company to operate without further regulatory action.

STEVEN PAPPAS

You are a 47-year-old representative of the union to which most employees of Industrial Disposal Systems, Inc. (IDSI), belong. Several union members have spoken to you recently about their fears that IDSI will be forced to close. They wanted to know what the union could do to help them, so you have spent considerable time looking into the IDSI case.

You have found that the regulations of the city, the county, and the state are costing IDSI a great deal of money. The regulations will require the company to install new and expensive equipment, which will raise operating expenses. The company will thus have less money available for salaries. Certainly, this is unacceptable to you and the union members. Another effect will be that IDSI will be forced to increase its prices. Customers may then dispose of their wastes in other ways, and IDSI will lose business and income.

You can't understand why people are so upset about the company. Everyone is claiming that IDSI represents a health hazard to the people of Warrington, but the company personnel records show no such problems among its employees. If there is a health problem, it certainly would show up among the employees first.

You believe this is a simple case of government overregulation. IDSI should be allowed to operate its plant in the manner that company officials feel is most effective. Rather than standing in the company's way, the Commission on Environmental Quality should take steps to help it dispose of wastes.

N.R. NOLAN

You are a 26-year-old employee of Industrial Disposal System, Inc. (IDSI). You have worked for the company for five years. The company pays very good salaries, and its benefit program--health insurance, life insurance, retirement, and so on--is excellent. You get along well with the other company employees and generally believe that IDSI is a fine place to work.

You are, however, worried about your future. The action taken by the Commission on Environmental Quality (CEQ) will have great impact on your life, especially if the CEQ forces IDSI to close. A few years ago, when the company stopped operating for about six months, you were laid off. Although you looked hard and had several interviews, you were unable to find another job. Your family depends on your income; if you were out of work again, serious financial problems would face the family.

The CEQ should, in your opinion, let the company determine the manner in which it will operate. Company officials do have concern for the environment, and you know that they have taken steps in the past to make sure that its incinerators operate efficiently and safely. Furthermore, the company has tried to provide training for new employees to ensure that they know how to identify potential problems at the plant and deal with them before they get out of hand. You believe that IDSI will dispose of all the wastes now on its Warrington site if the CEQ does not place unreasonable restrictions on the company's operation.

DOREEN VAN DEUSEN

You are the 41-year-old treasurer of Industrial Disposal Systems, Inc. (IDSI). For the past four years the company has faced serious financial problems. The repeated problems with equipment and licenses and permits have been a drain on the company's resources. IDSI is a relatively small business with limited assets.

In the past the company accepted more barrels of waste than it could incinerate in the hope of gaining enough income to pay for the purchase and installation of new air pollution control equipment. The plan was to dispose of this excess waste as soon as the new equipment was operational.

The proposed actions of the Commission on Environmental Quality (CEQ) may interfere with this plan. If the company is forced to accept a stipulation agreement, you are afraid that it will be impossible for IDSI to meet all its financial obligations. To save money the company would be forced to decrease its operations by laying off employees. This could mean a loss of income for the company, and the negative image of the company presented by the press would make it difficult to borrow money from local banks and other lending institutions.

If, on the other hand, the CEQ forces IDSI to close, a large number of workers will be unemployed, and Warrington and Bear Paw County will lose tax revenue. Furthermore, since it would then have no income, IDSI would be unable to pay for cleanup of the Warrington site. The city, county, or state would be forced to finance the cleanup.

You believe that everyone will benefit if the company is allowed to operate without further restrictions. The CEQ should take no action against IDSI at this time.

BILL MAHONEY

You are a 52-year-old engineer who has served on the board of the Quincy Commission on Environmental Quality (CEQ) since 1979. Industrial Disposal Systems, Inc. (IDSI), began operation that same year. As a long-standing member of the CEQ board, you are very familiar with the IDSI controversy and its history.

IDSI's major service since its formation has been to incinerate industrial chemical wastes. By 1979 the residents of Warrington had complained repeatedly about the smoke coming from the plant. In 1980, after long negotiations with the CEQ, the company installed new equipment--afterburners and scrubbers--to reduce air pollution from the incineration. The quality of the equipment IDSI installed was, however, inferior to what CEQ staff had recommended, and it was badly damaged by the corrosive materials being incinerated.

By March 1981, air pollution from the plant was again a serious problem. Again, the CEQ and Bear Paw County began court action to stop incineration at IDSI until the proper equipment was installed. The company shut down for six months to repair its equipment. In January 1981, the CEQ issued the necessary operating permits to the company. Despite the limits set in the permits, IDSI began to accept more barrels of waste than it could safely incinerate. A large number of barrels began to be stockpiled at the site. Then, in 1984, there was a fire at the company. This worried the residents of Warrington, but the company was back in operation within two weeks. Now there are between 20,000 and 30,000 barrels of waste stored at the Warrington site.

The short-term problem is the air pollution produced by the incineration. The long-term problems are the fire hazards, the potential for contamination of water supplies from seepage of wastes or leaking of sludge and ash, and the lack of an alternative disposal site. You are willing to listen to all points of view, but the alternative courses of action which appear most reasonable to you are:

--Recommending that the CEQ take no action at this time. Too many regulations currently affect the company's operation. Let Bear Paw County or Warrington officials handle the problem.

--Negotiating a stipulation agreement between the CEQ and IDSI to ensure that the company will install proper equipment and employ the most effective and safest disposal techniques.

RAMON MARTINEZ

You are a 41-year-old doctor who has served on the Quincy Commission on Environmental Quality (CEQ) board for the past three years. You are strongly committed to a clean and healthy environment for the state of Quincy. The problems with Industrial Disposal Systems, Inc. (IDSI), present a major threat, as you see it, to maintaining a healthy environment in the state. The air pollution, of course, is the most obvious problem. The smoke coming from the IDSI stacks is heavy and dark. It also contains a high concentration of particulate matter and has a very offensive odor. Obviously, such smoke poses immediate health problems for people near the IDSI site.

On the other hand, the barrels of waste now stored at the company site may present a more serious health hazard. If the company installs proper equipment and incinerates the contents of these barrels, the hazard can be minimized. But if the company does not incinerate these wastes, the barrels may corrode and the contents could seep into the ground. This could lead to contamination of the Warrington drinking water supply.

Although you are open to any reasonable solution to the IDSI problem, you are currently considering the following three courses of action:

--Take court action against IDSI to fine the company for permit violations until they meet the terms of their operating permits.

--Revoke the company's operating permits and take court action to close the Warrington site. State tax money would then have to be used to clean up the site.

--Negotiate a stipulation agreement between the CEQ and IDSI to ensure that the company will install proper equipment and employ the most effective and safest disposal techniques.

WILMA UREK

You are a 32-year-old professor of sociology at Quincy State University. You have served on the board of the Commission on Environmental Quality (CEQ) for three years.

Since there have been so many complaints about Industrial Disposal Systems, Inc. (IDSI), from the residents of Warrington and Bear Paw County, you believe the CEQ should carefully consider the possible reactions from residents before taking action.

Currently, the residents are primarily concerned with the short-term problem of the heavy smoke produced by incineration. They have complained about odors and possible damage to property and vegetation from this smoke. Most residents want the plant closed.

You believe that these people do not clearly understand the potential long-term problems presented by the large number of barrels on the site and by the sludge and ash piles. Some action should be taken to inform residents of these problems.

Furthermore, you are aware that considerable chemical waste from Quincy companies is currently shipped out of state for disposal and that much of it is disposed of illegally. Such illegal disposal includes dumping wastes into lakes, rivers, and open fields. You believe that if IDSI is forced to close, illegal disposal of chemical wastes will increase in Quincy.

Finally, you think that the state should begin an effort to develop a safe disposal site for chemical wastes. This will create an alternative to the IDSI operation for some Quincy businesses and will take some of the pressure off IDSI.

You are open to arguments from all sides of the issue, but the following courses of action seem most reasonable to you now:

--Recommend that the CEQ take no action at this time. Too many regulations currently affect the company's operation. Let Bear Paw County or Warrington officials handle the problem.

--Negotiate a stipulation agreement between the CEQ and IDSI to ensure that the company will install proper equipment and employ the most effective and safest disposal techniques.

--Take court action to allow the company to continue its operation only until all wastes currently at the Warrington site are disposed of properly. No additional wastes could be accepted by the company.

Role Card BG-27

EDNA CARLSON

You are a 47-year-old artist serving your fourth year on the Quincy Commission on Environmental Quality (CEQ) board. The problem at Industrial Disposal Systems, Inc. (IDSI) is one of the most serious you have ever faced.

Your major concern is what general impact IDSI has on the environment of Warrington and Bear Paw County. Will the effects be more serious if IDSI continues to incinerate the wastes stored on its site or if it is closed down and the wastes are not disposed of properly?

Here are some points that are clear to you:

--Incineration is probably safer and more effective than other forms of chemical waste disposal.

--IDSI has not always operated its incinerators safely; indeed, the company has repeatedly violated operating permits and laws.

--The 20,000-30,000 barrels at the Warrington site represent one of the largest know aboveground concentrations of hazardous wastes in the entire country.

--Although residents have complained about foul, sickening odors and heavy smoke, stopping the incineration will not resolve the problem. It may even lead to a more serious problem if the barrels begin to corrode.

Although you are willing to listen to all points of view, you are currently considering the following courses of actions:

--Take court action to prosecute company officials for past and current violations of local, county, and state environmental laws and regulations.

--Take court action to allow the company to continue its operation only until all wastes currently at the Warrington site are disposed of properly. No additional wastes may be accepted by the company.

--Negotiate a stipulation agreement between the CEQ and IDSI to ensure that the company will install proper equipment and employ the most effective and safest disposal techniques.

J.T. PETROCELLI

At 27, you are the youngest member of the Quincy Commission on Environmental Quality (CEQ) board. You are an investigative reporter for the Lakeville Times, the state's largest newspaper.

You believe that disposal of hazardous chemical wastes is one of this country's most serious environmental problems. If chemicals are disposed of improperly, several harmful effects may result. The chemicals may seep into the ground, and wells from which drinking water is taken may be contaminated. If the chemicals find their way into lakes or rivers, fish may be contaminated. Drinking contaminated water, eating contaminated fish, or even swimming in contaminated lakes lead to such ill effects as skin irritation, convulsions, high white cell counts, paralysis, leukemia, and tumors. In many other states chemical wastes have already contaminated some lakes and rivers. You don't want this to happen in Quincy.

Fortunately, the problem at Industrial Disposal Systems, Inc. (IDSI), is not yet out of control. The CEQ can prevent the kinds of long-term problems which might result if the wastes stored in the 20-30,000 barrels on the company site are not disposed of properly. The first step which should be taken is to identify clearly the contents of each barrel to determine which can be incinerated and which must be disposed of differently.

You believe that one of the following three courses of action will most effectively protect Quincy's environment; however, you are willing to listen carefully to arguments for other possible solutions.

--Revoke the company's operating permits and take court action to close the Warrington site. State tax money would then have to be used to clean up the site.

--Revoke the company's operating permits and take court action to close the Warrington site and to force IDSI to clean up the site.

--Take whatever action is necessary to prevent the shipment of additional wastes to IDSI until the company properly disposes of those barrels currently at the Warrington site.

SARAH KRONOWSKI

You are a 38-year-old businesswoman serving your first year on the board of the Quincy Commission on Environmental Quality (CEQ). For some years you have been concerned about the image of big business as irresponsible with regard to environmental issues. You believe this image is inaccurate. Many businesses and industries are very concerned about the quality of our environment and have taken important steps to ensure that harmful effects of the processes they use are minimized.

The Industrial Disposal Systems, Inc. (IDSI) problem is very complex. The company is providing an important service. It is, after all, the only hazardous waste disposal site in the state of Quincy. What would happen if it were forced to close? Where would manufacturing firms dispose of their chemical wastes? What effects would other disposal techniques have on the environment?

You believe the real problem at IDSI is what happens to the 20-30,000 barrels of waste currently stored at the site. How can proper cleanup of the site be ensured? There seem to be several ways to dispose of the barrels--incinerate their contents in the IDSI incinerators, bury the barrels in a suitable dump site, or ship the barrels to a dump site in another state. You are not sure which of these disposal techniques is best. So you are willing to listen to arguments from all sides.

Currently, however, you believe that it is best to interfere as little as possible with the company's operation. The following three courses of action seem most reasonable to you:

--Allow IDSI to continue operation with the understanding that its executives will do what they feel is right to correct the problem and dispose of the excess barrels at the site.

--Negotiate a stipulation agreement between the CEQ and IDSI to ensure that the company will install proper equipment and employ the most effective and safest disposal techniques.

--Recommend that the CEQ take no action at this time. Too many regulations currently affect the company's operation. Let Bear Paw County or Warrington officials handle the problem.

C.F. WASHINGTON

You have owned and operated your own business for seven years, even though you are only 29 years old. As a young person in the business world, you were honored when the governor of Quincy appointed you to the board of the Commission on Environmental Quality (CEQ) two years ago. You have always felt that business should share in the responsibility for keeping our environment clean.

The problem at Industrial Disposal Systems, Inc. (IDSI), poses several interesting questions. First, who is really responsible for the current situation? If the CEQ had been doing its job, thousands of barrels of waste should not have built up at the Warrington site. Obviously, the state, county, and city must cooperate more effectively to ensure that someone is responsible for keeping track of what is happening at IDSI.

Second, IDSI is being paid to accept the barrels of waste from the companies producing that waste. The company charges its customers $10-$50 per barrel of waste accepted. This means the company has been paid $200,000 to $1,500,000 for the waste which is simply sitting in its front yard. What is IDSI doing with that money? Why don't they use it to install better equipment?

Finally, what is in those barrels? The company is limited in the kinds of waste it can incinerate. Some of the wastes in the barrels stored at the Warrington site probably cannot be incinerated. Since there is no other disposal site in the state, what will be done with these wastes?

You have not yet decided what action should be taken, so you want to hear more discussion of the issue. On the other hand, you believe that one of the following three alternatives will be the best course of action:

--Take court action against IDSI to fine the company for permit violations until they meet the terms of their operating permits.

--Take court action to allow the company to continue its operation only until all wastes currently at the Warrington site are disposed of properly. No additional wastes may be accepted by the company.

--Negotiate a stipulation agreement between the CEQ and IDSI to ensure that the company will install proper equipment and employ the most effective and safest disposal techniques.

ACTIVITY 5
FINDERS KEEPERS: THE CONTROVERSY OVER SEABED MINING

OVERVIEW:

"Finders Keepers" is a role play which considers the international debate regarding exploitation of the ocean floor's mineral wealth. The case is based on the actual United Nations controversy of the 1970s, which culminated in the United Nations Convention on the Law of the Sea, signed in 1982. The arguments, positions, organizations, and nations represented are all based on testimony and evidence from actual participants in this controversy.

The procedure is basically the same as other activities in this publication: preliminary group meetings and research culminating in a simulated hearing to evaluate benefits and risks and decide upon the best course of action. However, the international context of this issue and the need for students to consider economic and political needs and realities of a number of nations adds a global dimension to the activity. Students may need more background or preparation going into this simulation than they have in other activities in this publication. In presenting cases, evaluating pros and cons, and reaching a decision, students will need a basic knowledge of the situations and needs of developing and developed countries. For this reason the activity is particularly appropriate as a culminating activity in a global studies, foreign policy, or contemporary issues unit.

Students are assigned roles representing the First Committee of the Law of the Sea, representatives of countries holding various views regarding the risks and activities associated with seabed mining, and other interested individuals. The students participate in a simulated First Committee hearing to argue which of the proposed systems of exploitation should be selected. The First Committee considers two basic alternatives.

--Exploiting the minerals on the seabed with no international control over private corporations or nations. This would simply be a licensing arrangement, and would best meet the needs of developed nations and nations with direct access to the sea.

--Exploiting the minerals on the seabed under a system of extremely strict controls, with major exploitation controlled by an International Seabed Mining Enterprise for the good of the world.

Students are divided into three groups: one representing each of the two positions on the issue and a decision-making body, the previously mentioned First Committee of The Law of the Sea.

Through several days of library research, the groups compile evidence to support their respective positions. To facilitate the research component of this activity, each group contributes the information they have compiled to a classroom resource center where all participants can obtain equal access to the information. They then present their evidence during a First Committee hearing, which provides the culminating activity for the exercise.

Following the hearing, the First Committee must reach a majority decision on the issue. A discussion analyzing the different viewpoints and the decision-making and risk-management processes concludes the activity.

OBJECTIVES:

Participation in "Finders Keepers" will enable students to:

1. Explain and discuss the social, political, and economic factors that influence decisions made on public policy issues of science and technology.

2. Identify and describe the central conflict involved in a problem requiring social action and decision making.

3. Clearly state the interests and values involved in a problem situation.

4. Recognize global needs and interrelationships.

5. Systematically analyze the risks in a problem situation and consider ways to minimize those risks. For example: What are the potential negative effects (risks)? Of what magnitude are the potential effects? What is the probability of the occurrence of these effects?

6. Recognize and evaluate the various and sometimes conflicting needs of individual countries involved in global conflicts.

7. Identify or state alternative solutions to a problem situation.

8. Identify and analyze the probable consequences of particular courses of action.

9. Analyze solutions to global problems.

GRADE LEVEL: 9-12

TIME: Approximately 7 class periods. The "Activity Timeline," Handout 1b, provides a schedule of activities.

MATERIALS: A world map, atlas, or globe for each of the three groups; 30 role cards

Handouts. Reproduce as indicated.

5a: Background Notes: The Controversy Over Mining the Seabed (1 per class member)
5b: Finders Keepers Activity Timeline (1 per group)
5c: Instructions to Group Leaders (1 per group)
5d: Risk Assessment (1 per group)
5e: Press Release (1 for First Committee)
5f: Finders Keepers Group Worksheet (1 per citizen's group)
5g: First Committee of the Law of the Sea Group Worksheet (1 for First Committee)
5h: Suggested Resources on Seabed Mining and International Law (1 per class member)
5i: How To Run a First Committee Hearing (1 per hearing examiner)
5j: Mining the Seabed Data Packet (1 for First Committee)

It is recommended that teachers send for materials on the Law of the Sea Conference from the Ocean Economics and Technology Branch, United Nations. Available free materials are:

Mining Deep Sea-Bed Minerals (DPI/DESI NOTE/587, 17 August 1981)

Levy, Jean-Pierre, and Nii Allotey Odunton. Economic Impact of Sea-bed Mineral Resources Development in Light of the Convention on the Law of the Sea.

Levy, Jean-Pierre. The Evolution of a Resource Policy for the Exploitation of Deep-Sea Bed Minerals.

Sea-Bed Mineral Resources Development: Recent Activities of the International Consortia.

PROCEDURE:

Pre-Simulation Preparation

Before beginning this activity, the class should read Handout 5a, "Background Notes," on the controversy over mining the seabed. This reading will be critical in providing you and your students the basic information needed to participate fully in the activity. Assign the "Notes" as a homework reading the day before the simulation is to begin.

Day 1: Introduction

A. (Optional) To introduce the activity, engage the class in discussion over some general issues surrounding scientific research and global economic development and competition. For example:

--Should the needs and goals of poor countries be given priority, since wealthier countries have always "gotten what they wanted"?

--Should any kinds of potential environmental damage be cause to stop a potentially beneficial mining project? Give examples.

--Can, or should, citizens of the world control the activities of major world corporations? Why or why not?

--Can, or should, citizens have a major voice in U.S. mineral policy? Should other countries be able to influence the mineral policy of the United States?

B. Use the information in the "Background Notes" for a brief presentation on the general issue of mining the seabed. Using the illustration from the "Background Notes," explain what mineral nodules are and how they can be mined. Ask students to speculate on some of the harmful effects and potential risks such mining might cause.

Next, introduce some of the basic issues of the role play through general class discussion.

--What are the differences between developed and developing nations?

--How might these two broad categories of countries look on seabed mining?

--Are these two categories of countries equally able to develop the seabed? Why or why not?

--How might geography of nations affect ability to compete?

--How might geography of nations affect concern over environmental effects?

Introduce the role play by explaining that there is money to be made by mining the seabed but corporations and developed and developing nations have differing views on how best to exploit these resources.

C. Highlight the specifics of the role-play situation and introduce students to the decision-making steps outlined in the "Conceptual Basis for CREST Activities" (pp 3-7).

D. Assign each student a role and distribute role cards.* Note that some roles may be played by either males or females. Divide the class into the following groups. Allow 10-15 minutes for participants to read their role cards and introduce themselves to their groups. During this time each participant should locate his home country on a map and show other group members its location.

Minimum Controls

Mr. or Ms. Rupertson
Mr. Jacobucci
Ms. Hernandez
Mr. Seidel
Mr. Nakagawa
Ms. Dupuy
Mr. or Ms. Hynes
Ms. Messimer
Mr. or Ms. Smorgrav

Strict Controls--Mining by International Enterprise

Mr. or Ms. Mapango
Mr. Bhartia
Ms. Uhuru
Mr. or Ms. Castaneda
Ms. Bala
Mr. Yassine
Mr. or Ms. Winter
Mr. Pal
Mr. or Ms. Delgado
Mr. Wilski
Ms. Tedesco

First Committee of the Law of the Sea

Mr. or Ms. Koh
Mr. Samson
Ms. Bustani
Mr. or Ms. Prijono
Ms. Lungu
Mr. Bailey
Mr. or Ms. Ivanov

E. Distribute to each group a copy of Handout 5b, "Activity Timeline," and quickly review its contents. Identify one or two leaders for each group. They will be responsible for ensuring that their group attends to its tasks. Each group leader should receive a copy of Handout 5c, "Instructions to Group Leaders."

F. The initial group task is to begin to assess the risks and benefits--environmental, political, and economic--related to seabed mining. Students should use information from the group members' role cards. The questions on Handout 5d, "Risk Assessment," should be used to guide discussion in each group.

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*If the class has fewer than 27 students, the same relative size should be maintained for each group. The unused role cards should be added to the data compiled for that group since the information in them is important for the group to consider. In larger classes, students can work in pairs on single roles.

G. (Optional) As homework, students should become completely comfortable with the information in their role cards. Teachers might assign students a re-reading of the "Background Notes" from the perspective of their role plays.

Day 2: Preliminary Hearing and Intragroup Discussions

A. As a class, take 5 minutes to review the information compiled yesterday on Handout 5d, "Risk Assessment."

B. Using "Risk Assessment" as a guide, the First Committee group conducts a brief (approximately 15 minutes) preliminary class-wide hearing focused on the following major questions:

--What are the potential negative effects of mining the seabed?

--How extensive will these effects be?

--How likely is it that these effects will occur?

Be sure the First Committee members understand that at this point everyone is operating with very little data. There will be some disagreement about the potential risks, especially the magnitude and the probability of their occurrence. In trying to assess the potential risks, the Committee might focus on the worst that could happen and identify the various positions on how likely it is that it will happen. More extensive discussion of the risks will take place during the activity's official hearing on Day 6.

C. Following the preliminary hearing, the First Committee prepares a news release on Handout 5e, "Press Release." This news release should be reproduced and distributed to the other groups.

After completing the news release, the First Committee should begin to consider the alternative courses of action provided on Handout 5g, the "First Committee of the Law of the Sea Group Worksheet." The group should identify important questions related to each alternative for use in guiding the discussion during the First Committee hearing.

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While the First Committee is preparing the news release, the other two groups should complete Parts I & II of Handout 5f, "Finders Keepers Group Worksheet." This is the first step in preparation for making presentations on their positions during the hearing. As the groups begin work on the worksheet, they should identify their proposed courses of action and discuss reasons for their positions. The reasons should be listed in the left-hand column of the worksheet. Group leaders should see that each group member identifies at least one reason for that group's position. Careful reading of the role cards will facilitate this process.

The teacher should monitor each group's progress, checking to see that they are focusing on relevant arguments. The following are some of the key arguments that can be made by each of the three groups in "Finder's Keepers." Students can find many of these arguments set forth in the background notes and in their role cards. During research on Days 3 and 4, groups will seek specific supporting data for the arguments they choose.

Minimum Controls

This group is primarily concerned with starting the recovery of seabed nodules as quickly as possible. Its members are in the best position financially and technologically to do so. The "free-enterprise," free-market system provides strong arguments for this group. Individuals around the world will benefit--albeit indirectly--by rapid exploitation of these vital minerals. Any world controls will hinder the search for profits that could ultimately help everyone. Faced with the argument of environmental risk, this group can illustrate that seabed mining has no proven harmful effects. Other strong arguments include the following: seabed mining will increase employment in many countries; industrialized nations, through their mining operations, will make the vague theory of "the common heritage of mankind" a reality; the world needs these strategic metals; and the seabed is a stable and long-term source. Some members of this group will accept weak controls over mining operations and/or a schedule of royalty payments to a world body. The main thrust, however, is toward no control or a simple licensing procedure.

Strict Controls, Mining by International Enterprise

The primary goals of this group are to control the corporations that want to exploit the seabed for their own profit and to create an International Seabed Mining Enterprise to mine the seabed on behalf of all nations. This group is primarily composed of representatives from developing countries or landlocked nations who cannot participate in seabed mining on their own at present or for a long time to come. This group stresses the disadvantage to poor and developing nations if the sea is left to a free enterprise system. They point out that the industrialized world cannot be trusted to respect the needs of all members. Their key argument centers around the declaration that the ocean is the "common heritage of all mankind." The International Enterprise would both mine on their behalf and exercise a stewardship over the minerals. Other arguments for this group are embodied in the principles of the New International Economic Order (see data packet). Restraint of uncontrolled exploitation by large corporations is the key.

Day 3-4: Research: Preparation for the Public Hearing

NOTE: A major component of this activity is to involve the students in research on the topic of seabed mining and international law. Each group of students will be responsible for locating information from a variety of sources to support the group's position on this issue.

Each of the two interest groups will collect at least one piece of information per person which they will use to support their arguments. They will share these materials with the rest of the class through a classroom resource center on Day 5.

Ideally, the teacher will be able to photocopy these materials for inclusion in the resource center. If this is not possible, students should check out materials for classroom use.

A list of suggested resources is provided in Handout 5h. Not all of these resources may be available to all schools and communities. Students should be encouraged to consult the local library, as well as the school library, and to contact local and national organizations.

Also distribute to each group a copy of Handout 5j, "Mining the Seabed Data Packet," which contains additional background information. Materials in this packet may supplement but should not substitute for student research materials.

Because the issues in this simulation are complex, the teacher may want to spend 10-15 minutes with each group helping them identify the kinds of information that would support their argument.

A. The First Committee will use Part II of Handout 1g, "First Committee of the Law of the Sea Group Worksheet," as a guide to its library research. Members must identify important questions for each alternative course of action, locate through the library or other sources information related to these questions, and record the references on the worksheet. This process will help them prepare for the public hearing. To question each of the groups after their presentations at the meeting, the First Committee members must have a clear understanding of all the information collected through research.

B. While the First Committee is conducting its research, the other two groups complete Handout 5f, "Finders Keepers Group Worksheet," in preparation for the public hearing. This will require them to conduct similar research, locating information to support the reasons they outlined on Day 2 for their positions. Each group should also consider possible compromise measures.

Teachers should remind students that the quality of each group's presentation, and ultimately its influence on the final decision, will depend on how rigorously group members conduct their research, how carefully they select relevant data, and how clearly they communicate this information during the public hearing.

Day 5: Research Sharing

A. To insure that all groups have equal access to information, Day 5 is designed as a resource sharing day. All materials compiled by all groups are to be made available in a classroom resource center. Tables at the back of the room or boxes with file folders can serve as the resource center. Each group should spend the first half of class looking at materials compiled by others. Instruct students to make notes of how these new materials might affect their own evidence, how to counter opposing or conflicting material with their own evidence, and so on. It is essential that the First Committee AND THE TEACHER to become familiar with all the evidence compiled.

B. During the last half of class, each interest group goes through its group worksheet and prepares arguments for the hearing to take place on Day 6. Each group will discuss how it presentation will be made. They will each pick a spokesperson and four witnesses to present at the hearing on Day 6. The spokesperson for each group will prepare to present the main arguments and supporting information, and each witness will be responsible for adding some new perspective and information. The witnesses should not merely repeat the same points made by the spokesperson. Remaining group members will act as prompters during the hearing and thus should be confident of all evidence and procedure.

C. The First Committee group should spend the last half of class reviewing all material on both sides of the issue, as well as reviewing Handout 5i, "How to Run a First Committee Hearing." At the end of Day 5, each of the three groups should be fully prepared for the public hearing.

Day 6: First Committee of the Law of the Sea Hearing

A. The First Committee conducts an open meeting according to the schedule which is outlined on Handout 5i, "How to Run a First Committee Hearing." The group advocating minimum controls over seabed mining should make its presentation first. The spokesperson should briefly present the major arguments; four witnesses will present additional points. They should all refer to specific references when supporting their arguments. Following each presentation, the First Committee should take several minutes to question the group to clarify its position. The pattern should be repeated for the strict controls group. During the meeting, the First Committee members use the questions they identified on their worksheet to guide discussion. They should also ask each group for information on the costs and benefits of their proposed course of action. Part III of the "First Committee of the Law of the Sea Group Worksheet" will be useful for this purpose.

B. After all presentations have been made, the First Committee should hold a five-minute question/answer and discussion session. The Committee should seek possible compromises from each group, if necessary.

C. When the discussion is completed, allow each group 2 minutes to plan a 1-minute final statement. Group spokespersons present the final statement to the hearing in the same order as the original arguments.

D. The First Committee holds a brief (5 minutes) private discussion in which they reach a decision on the issue. Emphasize to the Committee that they are free to choose either of the proposed options, or to come up with a compromise plan. The committee then announces the chosen course of action to the other groups.

Day 7: Final Discussion (Debriefing)

This phase is crucial in helping students recognize what steps they have followed in the risk-management/decision-making process.

A. Each group should spend 5-10 minutes discussing how the panel's decision will affect different nations or individuals.

B. Next, the teacher should have the class turn its attention to some of the key issues in the case. The following questions can be used to help guide the discussion:

--Did you accept the testimony of government officials, company spokespeople, scientists, and regular citizens equally? Explain.

--What, in the final analysis, are the major benefits and disadvantages of mining the seabed under the various conditions you discussed?

--Do you feel that a decision such as this one should be made as it was in our class? Should citizens have a strong voice in such policy issues? Should bodies such as the United Nations be able to control the activities of private corporations?

--What data were most persuasive in this case? Explain. What data were least convincing?

--Which position best meets the goal that the oceans serve as the "common heritage of mankind?" Why?

--Should developed nations be listened to more or less than developing nations? Alternately, should the goals and desires of developing nations be considered more important than those of developed nations?

--What are the various value differences between such spokespeople as a major corporation's president, president of a landlocked nation, coastal nation resident, resident of a very poor nation, and a research scientist? To whom did you best relate? Explain.

--Can technology such as that required for seabed mining ultimately solve the problems facing developed and developing nations? Has it caused more problems than it has solved? Give examples.

C. Finally, the class should consider carefully the decision-making and risk-management processes, using the following questions:

--Did all groups recognize the same risks? Why or why not?

--Were there any risks on which everyone agreed? What evidence was used to identify these risks?

--Which risks were seen as most serious? Why? Which were seen as least serious? Why?

--Who faced the risks (poor nations, wealthy nations, coastal nations, landlocked nations, and so on)? Did they voluntarily face these risks?

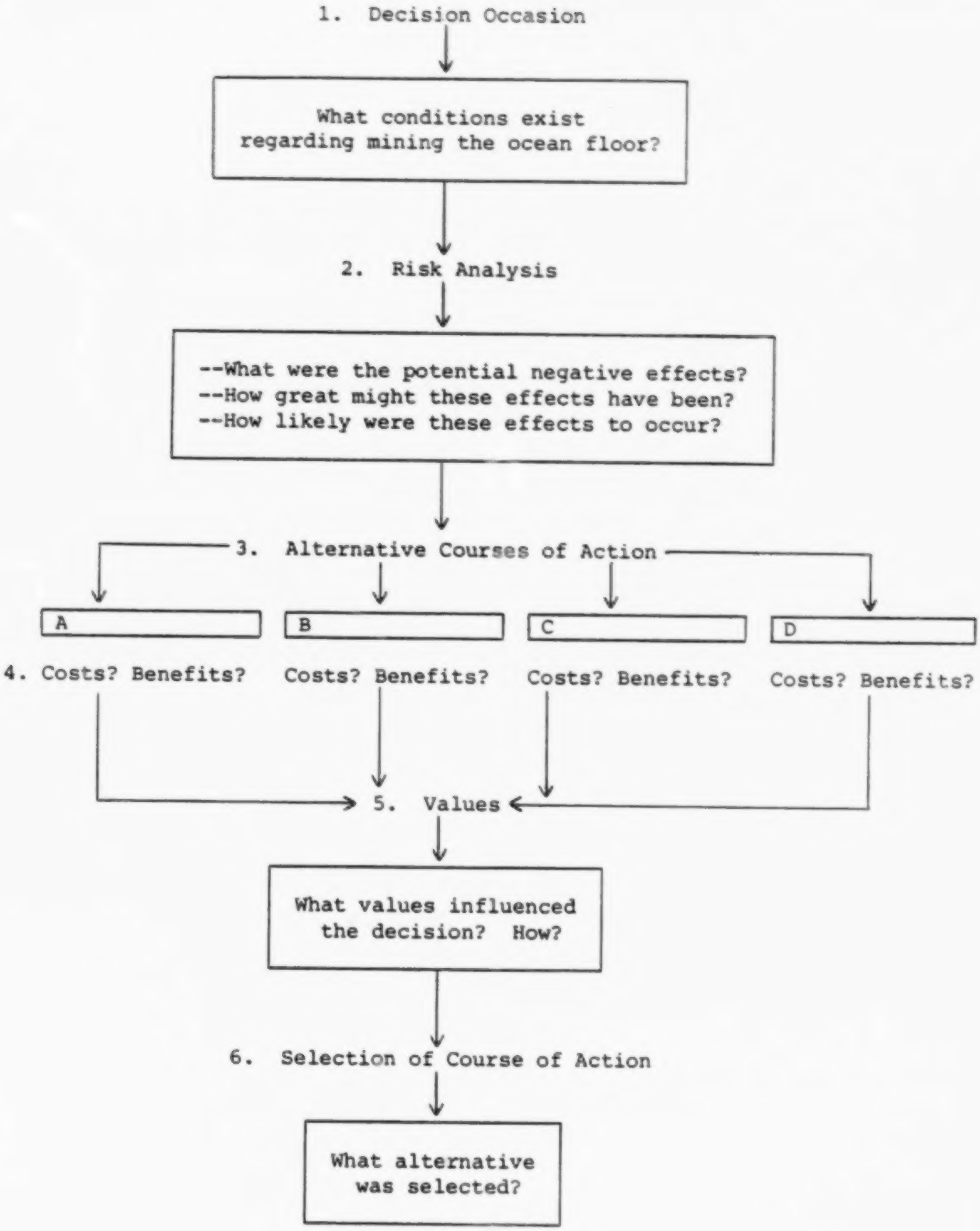
--Do you think it is fair for businesses or government to create risks for people without their knowledge or approval? Why or why not?

--Did wealthy and poor nations and their citizens fare equally in this situation?

--What values influenced the positions held by the different groups? How did these values affect the conflict over this case?

--What role did technology play in the seabed mining conflict? Did it help create the problem? Add to it? Help resolve it? Explain your answer.

D. Now, turn the students' attention to the decision-making process. Have them review the six decision-making steps followed in this activity. Then, use the framework below to review the process they followed in the case. As they answer the questions, you should fill in the framework on the chalkboard. This page may also be reproduced and assigned as homework at end of Day 6.


1. Decision Occasion
What conditions exist regarding mining the ocean floor?
2. Risk Analysis
--What were the potential negative effects?
--How great might these effects have been?
--How likely were these effects to occur?
3. Alternative Courses of Action
A
B
C
D
4. Costs? Benefits?
Costs? Benefits?
Costs? Benefits?
Costs? Benefits?
5. Values
What values influenced the decision? How?
6. Selection of Course of Action
What alternative was selected?

Ask the students to match the six decision-making steps with the six parts of the framework above. The following is a brief description of how they should match up:

Decision Making	Risk Management Framework
Defining the Issue	1. Decision Occasion 2. Risk Analysis
Recognizing Interests and Values	5. Values
Identifying Alternatives	3. Alternative Courses of Action
Locating and Using Information	All
Probable Consequences	4. Costs and Benefits
Selecting Course of Action	6. Selection of Course of Action

E. As a closure activity, have students compare their decision with the actual Law of the Sea, signed by 119 nations in 1982. The controversy, compromises, and final pact is well summarized in Elisabeth Mann Borgese, "The Law of the Sea," Scientific American (March 1983): 42-49.

F. (Optional) As an extension assignment, students might consider where the next international controversy over resources might be focused (Antarctica, the moon, outer space?). Have them find out to what extent this issue has already been raised or tested. Or have them write an essay on how the conclusions of their own simulation might apply to this projected case.

HANDOUT 5a: BACKGROUND NOTES: THE CONTROVERSY OVER MINING THE SEABED

This background guide for "Finders Keepers" will help you understand the history, technology, and political issues related to seabed mining and international legislation on seabed mining. The case enacted in this role play is based on an actual ongoing controversy before the United Nations between 1968 and 1982.

Seabed Minerals

In 1891, Sir John Murray and A. Renard reported the discovery of manganese and iron oxide nodules (see illustration) on the deep ocean floor during the exploratory voyage of the H.M.S. Challenger in 1873-76. During the following decades other oceanographic expeditions collected additional samples of nodules in many parts of the world, some of which showed the presence of one percent or more of other metals, notably nickel, copper, and cobalt. In 1957, John Mero, then a graduate student at the University of California in Berkeley, became interested in the possibility of mining the nodules. He recognized that the metal content of the nodules exceeded that of many of the ores being mined on land. Mero's work on the mineral resources of the sea interested some mining companies in the possibility of deep ocean mining.

Today three pure elements (magnesium, bromine, and tin) and a compound of two others (sodium chloride--table salt) are being extracted from seawater in appreciable quantities. Seawater contains these particles in a dissolved form and must undergo processing before the elements are condensed and recovered. This is not the case for all elements found in the ocean. During millions of years, some elements--namely, manganese, copper, nickel, and cobalt--have precipitated out of the water to form nodules covering much of the ocean floor.

While sampling the ocean floor at various locations, researchers have repeatedly recovered small, black, rock-like specimens that were found to contain concentrations of manganese (approximately 25 percent), copper (1.2 percent), nickel (1.5 percent), and cobalt (0.2 percent). Later expeditions have found the nodules in more widespread oceanic locations, leading researchers to theorize that the nodules must cover large portions of the ocean floor. It has since been proven that the nodules are indeed abundant and exist in almost all major oceans through the world. However, the richest and most concentrated nodule fields are found in the Pacific Ocean southeast of Hawaii and just north of the equatorial zone in 14,000 to 18,000 feet of water.

An average nodule is about two inches in diameter, potato-shaped, with an irregular surface. The nodules can be found in water as shallow as 100 feet or as deep as 20,000 feet. It is estimated that 1.5 trillion tons of manganese nodules are located in the Pacific Ocean alone; at present rates of consumption these reserves could supply world needs for hundreds of years.

In the more than 100 years since their discovery, very little has been learned about their origin. Through modern oceanographic techniques the richest and most concentrated nodule fields have been surveyed and plotted, and methods have been developed to retrieve them in quantity from the crushing depths of the ocean. But exactly how and why they are formed remains a mystery, although most researchers agree that biological organisms inhabiting the ocean floor somehow assist in their formation.

At the core of every nodule is a foreign substance that acts as a nucleus from which the nodules grow. This substance has been found to be made of bone fragments, shark's teeth, coral, clay, metal chips, or the most common--basalt, a rock-like substance of volcanic origin.

Even the speed at which nodules are formed is in question. The slowest growth has been radioactively dated at one millimeter per one million years, while other nodules of substantial thickness have been found growing on such manmade objects as artillery shell fragments and spark plugs.

The Controversy over Seabed Mining

International political attention began to focus on seabed minerals in 1945 when President Harry Truman claimed sovereign rights over the minerals of the U.S. continental shelf. The first United Nations Law of the Sea Convention held in Geneva in 1958 succeeded in producing the 1958 Geneva Conventions on the Territorial Sea and Contiguous Zone, the High Seas, Fishing and Conservation of the High Seas, and the Continental Shelf. The Shelf Convention gave coastal states jurisdiction over seabed resources of their continental shelves. Minerals beyond the continental shelves were not considered then, but under the 1958 High Seas Convention, ocean resources could be harvested and used by any state, although none could claim jurisdiction over any part of the high seas.

At the dedication of the research vessel Oceanographer in 1966, President Lyndon Johnson said, "We must ensure that the deep seas and ocean bottoms are and remain the legacy of all human beings." In a famous speech to the U.N. General Assembly in 1967, Malta's Ambassador Arvid Pardo described these regions as the "common heritage of mankind" and proposed that a committee be established to consider how deep-sea resources could be developed for the benefit of all mankind and also take into account the special needs of the developing countries. The General Assembly then adopted a resolution establishing the U.N. Committee on the Seabed and Ocean Floor Beyond the Limits of National Jurisdiction, which held its first meeting in June 1968.

Pardo wanted the committee to designate the oceans as mankind's "common heritage," which he defined as "international trusteeship" instead of "common ownership." This phrase divided the committee for years. On one side was the "Group of 77" (actually numbering more than 120). This group consisted of developing countries such as Brazil, Peru, Tanzania, and Algeria, which stood to gain from a common harvesting of the ocean. On the other side were the western developed nations, which wanted their mining companies to be free to mine minerals from the ocean floor.

Not all countries fell logically into these two groups. National interests often took a more subtle form. For example, both Canada and the Soviet Union jumped between camps. But for the most part, negotiations were a give-and-take between have and have-not nations.

The negotiating text developed by the U.N. Committee of the Seabed contained 303 articles and eight annexes in 200 pages. The highlights included:

--Establishment of a uniform 12-mile territorial sea.

--Recognition of a 200-mile exclusive economic zone, within which coastal nations exercise "sovereign rights for the purpose of exploring and exploiting...natural resources."

--Rights of passage for all ships (including warships) over the high seas and through navigational straits. Overflights of airplanes also are permitted.

--Complicated procedures for settling disputes.

--Miscellaneous articles that would control pollution from ships at sea, protect marine mammals, and severely restrict marine scientific research.

The Group of 77 saw the committee as a chance to narrow the gap between the countries of the Northern and Southern Hemispheres through a new international economic order. Their tool would be the mining division of the proposed International Seabed Authority, called the Enterprise.

According to a source close to the Group of 77, the Enterprise got its name from the spaceship of the popular TV series "Star Trek." The show is broadcast widely throughout Latin America and features a cast of international characters working toward common goals.

U.S. critics, however, held that the Enterprise was a third-world rip-off rather than a model of international cooperation. Taken as a whole, they said, the treaty was a mass of sticky clauses and hidden traps for the developed countries.

The following concerns were raised by several developed nations and corporations (generally multinational) that had expressed great interest in exploiting resources on the seabed. In fact, these issues contributed to the 1980 decision by the U.S. government to stall ratification of the seabed mining treaty:

--Assured access for mining companies. Four consortia, each headed by an American corporation, had poured millions into developing seabed mining technology. Under the negotiating text, critics said, there was no assurance that the International Seabed Authority would give these consortia permission to mine the strategically important minerals.

--Interim production limits. To protect land-based mineral suppliers, the International Seabed Authority would oversee complicated production limits tied to world nickel demand. The limits could be in effect for more than 25 years.

--U.S. companies and some foreign policy experts had long worried that land-based suppliers would band together into OPEC-like cartels. Unlimited seabed production, they said, would protect the United States against this threat. Other experts discount this problem, pointing out that such attempts as that of the International Bauxite Association had failed to increase prices.

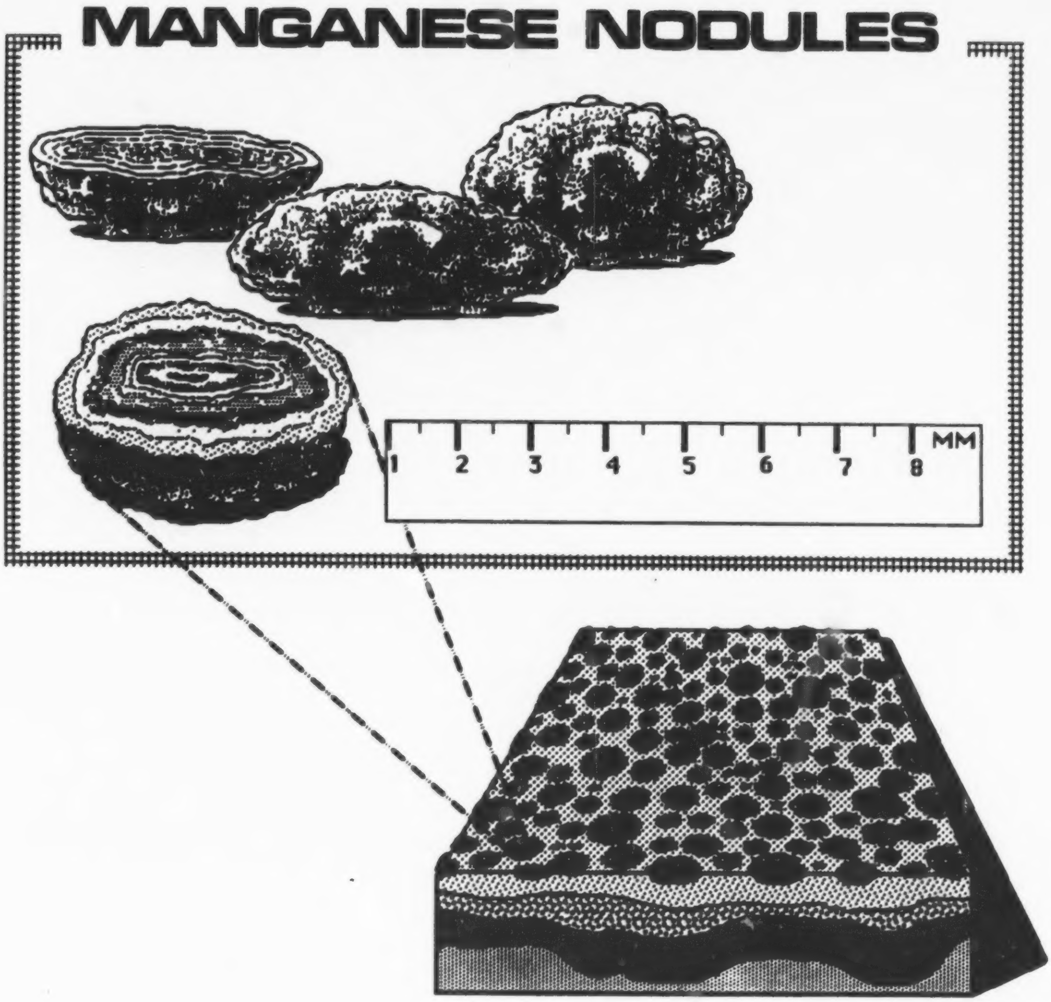
--The bureaucracy of the International Seabed Authority. The International Seabed Authority would be organized much like the United Nations, with a general assembly and a more exclusive council. Critics contended that the Group of 77 could dominate the authority through the assembly.

--Who could participate, or the "PLO question." The negotiating text would allow "peoples who have not attained full independence or other self-governing status" to share in the ocean's bounty, raising the specter of international "liberation" movements joining the authority.

--Precedence. Critics felt the "common heritage" concept sets a bad example for other undecided issues, such as the moon treaty and the question of who owns Antarctica.

--The review conference. After 15 years of mining, a conference to scrutinize the seabed mining machinery would be convened. If the conference couldn't reach a consensus after five years, new mining regulations would be established by a two-thirds vote. Theoretically, the Group of 77 could then wipe the slate clean and the United States might find itself signatory to a treaty that ignored its economic interests.

A "Convention on the Law of the Sea" was signed in 1982, after 15 years of negotiation. A total of 119 nations signed the agreement, which outlined laws and a development program which went into effect in 1983. In this activity, you will recreate a simplified version of the controversy and negotiations involved in developing the Law of the Sea. At the conclusion of the activity, you will be able to compare your course of action to the final program agreed upon by the U.N. signatories.


MANGANESE NODULES
1
2
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MM

Handout 5b: FINDERS KEEPERS ACTIVITY TIMELINE

	Day 1	Day 2	Day 3-4	Day 5	Day 6	Day 7
First Committee of the Law of the Sea	--Participate in introductory activities --Receive role assignments, form groups --Prepare for preliminary hearing	--Conduct preliminary hearing --Prepare and distribute press release --Receive handout 5g; begin research	--Conduct research in order to prepare questions on alternative courses of action --Prepare for running First Committee hearing	--Compare research findings in class --Finalize preparation for running First Committee meeting	--Conduct public hearing --Listen to presentations of other groups --Question other groups on cost/benefits of alternative courses of action --Reach decision	--Discuss effects of decision --Participate in class discussion and debrief
Minimum Controls Over Seabed Mining Strict Controls, Mining by International Enterprise	↓	--Participate in preliminary hearing --Identify reasons for group course of action --Begin research	--Research --Identify supporting evidence	--Compare research findings in class --Select spokesperson and four witnesses --Prepare presentations for meeting	--Make group presentations --Answer questions from other groups --Listen to other groups' presentations --Ask questions of other group	↓

627

Handout 5c: INSTRUCTIONS TO GROUP LEADERS

YOUR PRIMARY TASKS ARE TO ASSEMBLE YOUR GROUP AND GUIDE THE GROUP IN PREPARING A LOGICAL ARGUMENT FOR ITS POSITION. HELP THE GROUP SELECT A SPOKESPERSON AND UP TO FOUR WITNESSES WHO WILL BE CALLED ON TO SPEAK AT THE HEARING. EACH GROUP MEMBER SHOULD PRESENT AND EXPLAIN AT LEAST ONE REASON FOR THE GROUP'S POSITION. YOUR GROUP SHOULD TRY TO PROVIDE AS MUCH STRONG EVIDENCE AS POSSIBLE TO SUPPORT ITS POSITION. BE SURE EVERYONE HAS LOOKED CAREFULLY AT THE AVAILABLE DATA. YOU SHOULD ALSO CONSIDER ALL THE CONSEQUENCES OF THE VARIOUS ALTERNATIVES BEING DISCUSSED.

Handout 5d: RISK ASSESSMENT

It is important to clearly understand the implications of the issue facing your group. One way of doing this is to assess the risks involved in mining the seabed.

Use the following questions and information from your role cards to make this risk assessment.

1. What potential negative effects may result from mining of seabed minerals?

   a. Who will be likely to experience these effects?

   b. Where or how widely will these effects be experienced?

   c. How soon are these effects likely to be experienced?

   d. How easy will it be to reverse these effects? Why?

2. How great are these negative effects likely to be?

   a. How many people and what type are likely to be affected physically or psychologically?

   b. How great is the environmental damage likely to be?

   c. How costly are these effects likely to be?

3. What are the chances that these negative effects will actually occur?

Handout 5e: PRESS RELEASE

FIRST COMMITTEE OF THE SEA CONSIDERS RISKS FROM MINING THE OCEAN'S FLOORS

At a preliminary hearing yesterday the First Committee of the Law of the Sea discussed the potential hazards of seabed mining plans. Among the questions considered were:

--What are the likely negative effects?

--How great are these negative effects likely to be?

--What are the chances that these negative effects will actually occur?

Potential negative effects identified by various spokespeople at the hearing included. . .

There were speculations on the extent of these effects. Some of those discussed were. . .

Much of the discussion focused on the likelihood that these various effects would occur. General feelings included. . .

Handout 5f: FINDERS KEEPERS GROUP WORKSHEET

PART I: Participants

Name of Your Group's Spokesperson:

____

Name of Your Group's Witnesses:

____

____

____

____

Other Group Members:

____

____

____

____

PART II: A Recommended Course of Action

1. State clearly the course of action your group believes would be best to follow:

____

____

2. Based on the information presented in your role cards and in the "Background Notes", what are all the possible reasons for your position? For example, if your group advocates the strict controls, its reasons may include:

--The ocean floor represents the "common heritage" of mankind and no nation or company should get all the wealth from it.

--The seabed mining could cause environmental damage.

--Without strict controls, producers of minerals from land mines could be hurt.

LIST YOUR GROUP'S REASONS IN THE SPACES ON THE LEFT-HAND SIDE OF PAGE 2 OF THIS WORKSHEET. EACH GROUP MEMBER SHOULD IDENTIFY AT LEAST ONE REASON.

PART III: Research

Through library research, find information to support each reason you listed for question 2. For example, look at the second reason above--"mining could cause environmental damage." What evidence is available to support this reason? ENTER YOUR REFERENCE ON THE RIGHT-HAND SIDE OF PAGE 2.

	Reasons	Supporting Information
A.		
B.		
C.		
D.		
E.		
F.		

PART IV: Costs and Benefits

1. Outline briefly the costs and benefits of taking the course of action recommended by your group. This information will help you clearly state arguments for your position during the First Committee hearing. Cite references you have identified next to specific costs and benefits.

An example is provided for you here.

Example: Minimum or no controls over seabed mining.

Costs	Benefits
--Anger of many poorer nations that they have been "robbed" of their rights to the sea floor	--Less worry about getting important "strategic" minerals
--Environmental damage to ocean area near seabed mining sites	--Many potential jobs and possible large profits
--Economic damage to land-based producers of these metals	--A greater chance for other countries to get important aid money

Your Group's Alternative Course of Action: ______________________________

____

____

Cost	Reference	Benefit	Reference

Use a separate sheet of paper if necessary.

Handout 5g: FIRST COMMITTEE OF THE LAW OF THE SEA GROUP WORKSHEET

Your group is charged with making a decision on the proposed systems for mining the beds of the world's oceans. You must decide what is to be done on this issue. How necessary do you consider this proposed mining to be? How critical are the potential risks? Is it possible to mine the seabed and make all parties happy? Of course, many questions must be raised and answered.

PART I: Alternative Courses of Action

As a group, you should clarify the possible courses of action which may be taken in this case. List these alternative courses of action below (remember, each alternative for regulation should consider WHAT, HOW, and WHO):

1. ______________________________

____

2. ______________________________

____

3. ______________________________

____

PART II: Questions for the First Committee of the Law of the Sea Hearing

During the First Committee hearing, you will want to ask questions of each group to help clarify their arguments. This will help you to make a good decision. Each role has several questions or concerns. These should be listed, along with other questions that come to mind, in the appropriate areas below. Some questions may be asked of more than one group. You will also want to consider possible compromise positions. Finally, you will spend time researching answers to these questions and educating yourselves. You want to be knowledgeable decision makers. Place the references you find that you think help to answer the questions on the worksheet.

ALTERNATIVE 1:

	Question	Reference
A.		
B.		
C.		
D.		

ALTERNATIVE 2:

	Question	Reference
A.		
B.		
C.		

D. ______________________ ______________

______________________ ______________

______________________ ______________

POSSIBLE COMPROMISE POSITION: ______________________

____

Question	Reference
A. ______________________	______________
______________________	______________
______________________	______________
B. ______________________	______________
______________________	______________
______________________	______________
C. ______________________	______________
______________________	______________
______________________	______________
D. ______________________	______________
______________________	______________
______________________	______________

PART III: Costs and Benefits

For each alternative presented during the hearing, outline the costs and benefits of taking that course of action. COMPLETE THIS SECTION DURING THE FIRST COMMITTEE HEARING. A partial example for one alternative course of action is provided for you. Be sure to add costs and benefits as they are mentioned by the groups and to ask for clarification where necessary. This will help you make your final decision.

Example: Minimal or no controls over seabed mining.

Costs	Benefits
--Anger of many poorer nations that they have been "robbed" of their rights to the sea floor	--Less worry about getting important "strategic" minerals
--Environmental damage to ocean area near seabed mining sites	--Many potential jobs and possible large profits
--Economic damage to land-based producers of these metals	--A greater chance for other countries to get important aid money

Group 1, Proposed Course of Action: ____________________________

____

____

____

Cost	Reference	Benefit	Reference

Group 2, Proposed Course of Action:

Cost	Reference	Benefit	Reference

Possible Compromise Position:

Cost	Reference	Benefit	Reference

Handout 5h: SUGGESTED RESOURCES ON SEABED MINING AND INTERNATIONAL LAW

Listed below are some journal articles, library resources, and contact organizations to get you started on compiling information for the upcoming First Committee hearing. Note: Some of your best information will come from recent newspaper and magazine articles, so be sure to check the *Readers' Guide to Periodical Literature*, *Magazine Index*, and any newspaper indexes available in your school or local library.

LIBRARY RESOURCES

Annual Editions: Environment 84/85. Guilford, CT: Dushkin Publishing Group, 1984.

Annual Editions: Global Issues 85/86. Guilford, CT: Dushkin Publishing Group, 1984.

Development Data Book. Washington, D.C.: The World Bank, 1984.

Facts on File. New York, NY: Facts on File, Inc., 1985. A weekly digest and index of news, compiled from major national and international newspapers.

Hedley, Dan. *World Energy. The Facts and the Future*. New York, NY: Facts on File, Inc., 1985.

Taking Sides: Clashing Views on Controversial Environmental Issues. Guilford, CT: Dushkin Publishing Group, 1984.

JOURNAL ARTICLES

Farney, F.C.F. "Ocean Space and Seabed Mining." *Journal of Geography* 74(1975):539-547.

Farney, F.C.F. "Law of the Sea, Resource Use, and International Understanding." *Journal of Geography* 84(May-June 1985):105-110.

Glassner, M.I. "The Law of the Sea." *Focus* 28:1-24.

McDonald, A. "Mines in a Lawless Sea." *The Geographical Magazine* 54(September 1982):501-503.

Wertenbaker, W. "A Reporter at Large (Law of the Sea Conference)." *The New Yorker* 1(August 1983):38ff; 8(August 1983):56ff.

CONTACT ORGANIZATIONS

Energy Resource and Development Administration. Washington, DC 20545.

United Nations. Ocean Economics and Technology Branch. See United Nations Convention on the Law of the Sea: Draft Final Act of the Third United Nations Conference on the Law of the Sea, December 10, 1982.

Worldwatch Institute. 1776 Massachusetts Avenue, N.W., Washington, DC 20036.

Handout 5i: HOW TO RUN A FIRST COMMITTEE HEARING

1. Announce the purpose of the hearing at the beginning.

2. Strictly enforce time limits on each group.

3. In order to maintain control:

   --Have all comments addressed to you.

   --Call on people who raise their hands.

   --As much as possible, give each group equal time.

   --Stress the need for participants to refer to specific sources of information when presenting arguments.

   --Question group members, but don't squabble with them.

   --Have all presenters initially state their names, places of residence, if possible, and professions.

4. Your agenda should be:

   a. Minimum-or-no-controls-over-seabed-mining group

      (1) Group leader

      (2) Maximum of three additional spokespeople

      (3) Questions to that group only from the First Committee members

   b. Strict-controls-over-seabed-mining group (same as above).

   c. General discussion and questions from the First Committee members. EXPLORATION OF COMPROMISE SOLUTIONS

   d. Concluding remarks (1 minute) from each group.

   e. First Committee confers, then announces decision.

   f. Discussion of reasons for chosen course of action.

Handout 5j: MINING THE SEABED DATA PACKET

This packet contains six documents to help you prepare for your upcoming First Committee of the Law of the Sea hearing. These documents are: I - Seabed Minerals Information Sheet; II - Seabed Mining Systems; III - Ocean Floor Minerals and Resources; IV - Basic Ideas of International Law; V - United Nations Principles Governing the Seabed; and VI - Congressional Record Report on Sea Citizenship.

Use the information in this packet to supplement your library research.

I. Seabed Minerals Information Sheet

Manganese Modules*

Offshore oil and gas comprise an important part of the world's energy reserve. In addition, offshore mining yields some valuable minerals such as sulphur, tin, and iron ore. Still largely untapped, however, are the world's largest metal resources. These are found on the ocean floor in billions of metallic lumps, which range from marble size to football size. Marine geologists sometimes use samples as paperweights on their desks.

Nickel, Copper, Cobalt

These lumps are known as manganese nodules after the metal which is one of their principal constituent elements. But the value of these modules lies in the metals which they contain in much smaller amounts: nickel, copper, and cobalt. A nodule of commercial value would be about 3 to 5 inches in diameter and could contain about 55 percent manganese, 1.4 percent copper, 1.6 percent nickel and 0.3 percent cobalt. There are too many unknowns surrounding the mining of ocean minerals to predict when and in what quantities they will come to market, but geologists expect that commercial operation will get underway during the 1980s.

Ubiquitous Nodules

Manganese nodules are found in all the oceans. On the ocean floor they sometimes form slab-like encrustations. In the Pacific Ocean, it is estimated that as many as 90 billion tons of nodules may be found.

Scientists are not sure how nodules come to be formed. Most scientists believe that tiny metal grains precipitate from chemical solutions (for example, saltwater) originating from runoffs of continental rivers, out of volcanic eruptions on the ocean floor, and out of submarine springs. Once precipitated, the metal particles combine to form nodules. The process is slow, varying anywhere from 0.1 to 1 millimeter in a single year in shallow waters off the continental slope, or as long as 1,000 years for the same accretion when it occurs on the abyssal ocean floor.

What Is a Mineral Nodule Worth?

The valuable minerals in a nodule appear in small traces. A ton of nodules would produce only thirty pounds of nickel, used to make stainless steel alloys and refine gasoline, and only five pounds of cobalt, used to harden the high-grade steel used in jet engines. It would take

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*Based on Treasures of the Sea: Manganese Nodules. New York: Center for Economic and Social Information, Ocean Economics and Technology Office, United Nations, 1974.

182 tons of nodules to produce enough cobalt to build one turbofan engine for an F-16 fighter plane. But that's the way it is with these minerals; no richer veins are to be found on land.

Although a four-ounce nodule the size of a hen's egg contains about two cents' worth of minerals, the things do add up. Recently the U.S. Bureau of Mines assayed a ton of nodules from the South Pacific--not even enough nodules to fill up a canoe. This ton of nodules contained $109 worth of nickel, $72 of cobalt, $24 of copper, and $42 of manganese. It also contained $41 worth of molybdenum. By contrast, a ton of copper ore from an Arizona open-pit mine is likely to have a value of $8.50.

II. Seabed Mining Systems

There are three major systems used for mining the ocean's floor. These are the hydraulic mining system, the modular mining system, and the continuous line bucket mining system. Each is outlined below and illustrated in the accompanying diagram.

Hydraulic Mining System

This system works a little like a vacuum cleaner. Nodules are collected by a bottom miner and fed into a vertical pipe which carries them in a mixture with seawater to the mining ship.

Bottom miner. The bottom miner is the most complex part of the system. The miner sweeps up the nodules in its path, separates them from the sediment, and feeds them into the pipe. In some systems a preliminary crushing stage is included in the miner.

For movement on the seafloor, the miner may be either self-propelled or towed. A self-propelled remote-controlled bottom miner is able to move along the bottom within the limits of its connection with the lift pipe.

Lift system. The nodules collected by any of these bottom miners can be lifted to the mining ship by two alternative lift systems: hydraulic pump lift and air lift. With the hydraulic pump life, submerged pumps provide the required pressure to life nodules to the surface. With the air lift, compressed air is injected into a pipe at various depths to cause upward movement and suck the slurry. An important advantage of the air lift system is that the major moving components are mounted on the mining ship, making repair fairly easy. Major problems with this system are the expansion of the injected air as it reaches the surface and separation of this air from the slurry. Both lift systems have been tested at operational depths.

Mining ship. The mining ship must provide structural support for the subsurface systems; provide a means to deploy, recover, and repair the subsurface systems; supply power to the subsurface systems; accurately position and propel the mining system over the mine site; provide for ore transfer to the transport vessel; and provide storage for accumulated ore. The mining ship, with its central well for the deployment of the lift system and the bottom miner, is similar to a drill ship, but considerably larger.

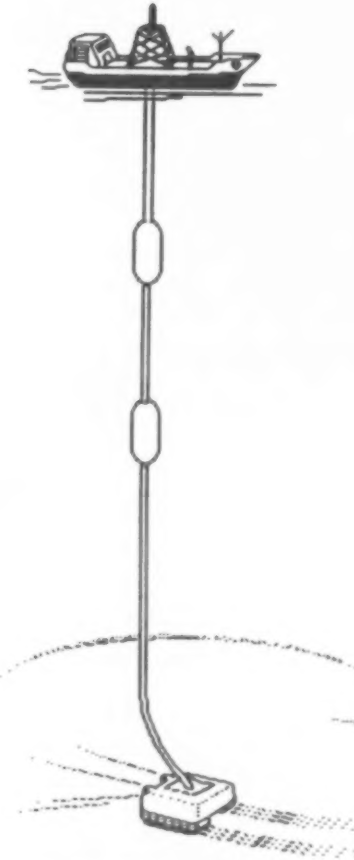
Modular Mining System

This system uses a number of free-swimming miner units which are propelled to the ocean floor. There they locate and collect the nodules, de-ballast, and return to the surface. The miner units rise to a surface ship, are unloaded, and then redeployed. Each miner is launched with tailings ballast so that the weight in water of the ballast is equal to the weight in water of the nodules to be collected. As collection proceeds, tailings are ejected.

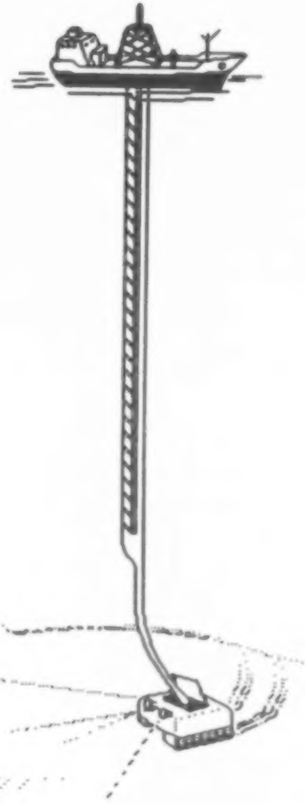
Continuous Line Bucket (CLB) Mining System

The CLB system uses a long, continuously rotating loop of line to which dredge buckets are attached. Empty dredges are lowered to the ocean floor from one ship, filled with nodules as they are towed over the bottom, and then pulled to a second ship for emptying. The loop of line moves continuously so that a constant stream of buckets filled with nodules is received aboard the second ship.

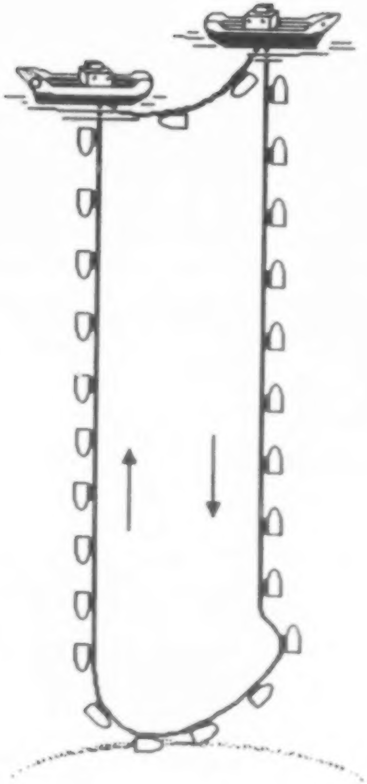
SEABED MINING SYSTEMS



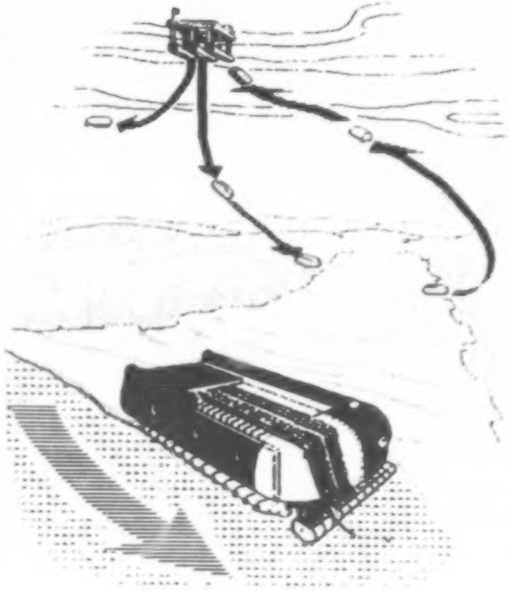
Hydraulic mining
with hydraulic lift



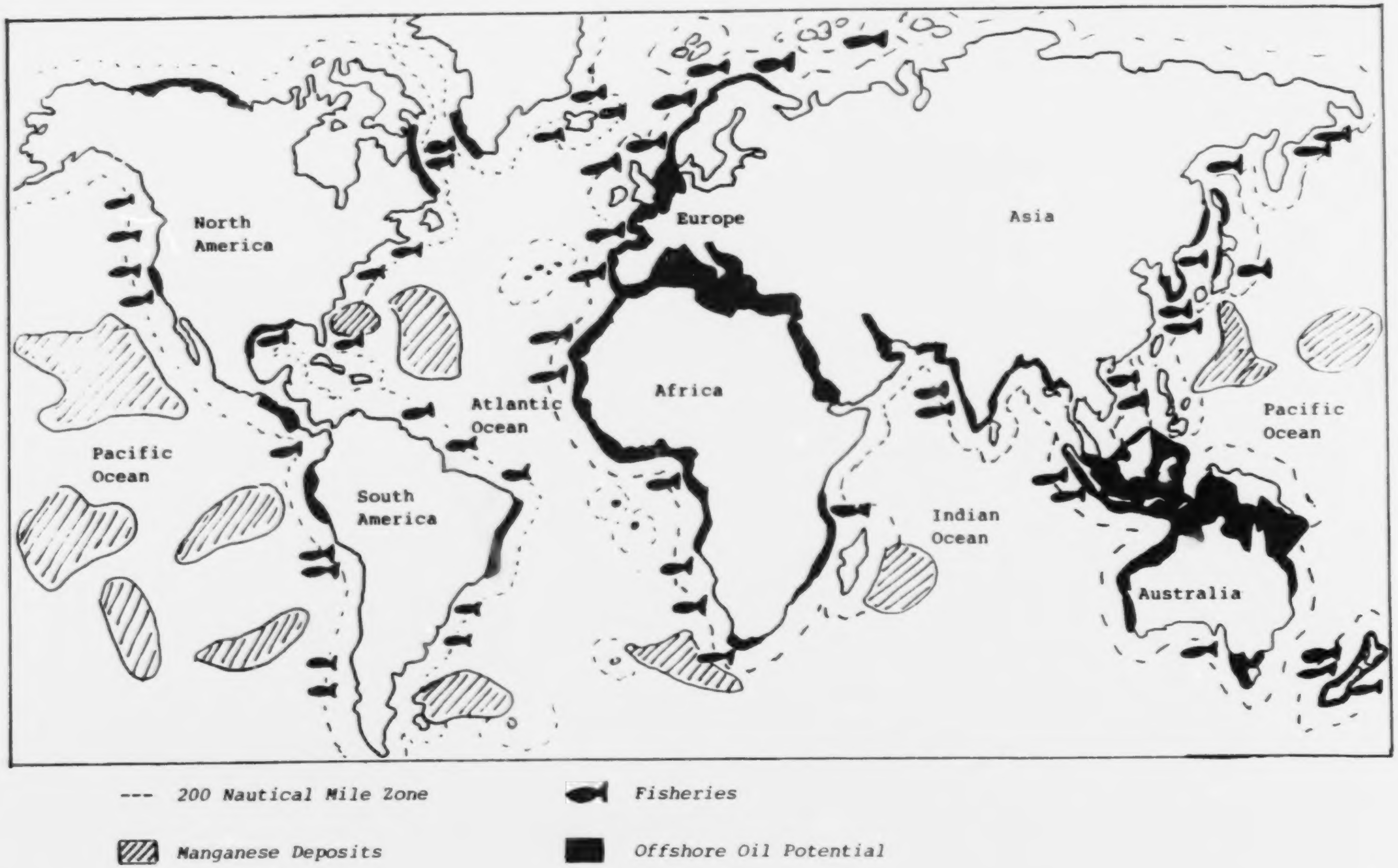
Hydraulic mining
with air lift



Continuous line
bucket mining



Modular mining


North America
Europe
Asia
Pacific Ocean
Atlantic Ocean
Africa
Pacific Ocean
South America
Indian Ocean
Australia
--- 200 Nautical Mile Zone
Fisheries
Manganese Deposits
Offshore Oil Potential

IV: Basic Ideas of International Law

A. The oceans must remain open to all nations for the purposes of scientific study.

B. Any nation's activities must be conducted with due regard for the rights of other nations.

C. Any activity undertaken must be done in a way that maintains world peace and avoids adverse environmental effects.

--From the United Nations
Law of the Sea
Conference Proceedings

V. Principles Governing the Seabed

On the basis of the work of the Seabed Committee, the General Assembly in 1970 adopted unanimously the Declaration Principles governing the seabed and ocean floor. Some of the major points are summarized below.

1. The seabed and ocean floor, and the subsoil thereof, beyond the limits of national jurisdiction, as well as the resources of the area, are the common heritage of mankind; the area is not subject to appropriation and no state may claim or exercise sovereignty or sovereign rights over any part thereof; no state or person shall claim, exercise or acquire rights with respect to the area or its resources incompatible with the international regime to be established and the principle of this declaration.

2. The area is open to use exclusively for peaceful purposes.

3. The exploration of the area and exploitation of its resources are to be carried out for the benefit of mankind as a whole; any nation's activities must be conducted with regard for the rights of other nations.

4. States shall act in the area in accordance with the applicable principles and rules of international law, including the UN Charter, and in the interests of maintaining international peace and promoting international cooperation and mutual understanding.

5. Any activity undertaken must be conducted in a way that avoids environmental damage.

It is the first time in history that the concept of common heritage has found expression in an international instrument. It is perhaps even more significant that an area of at least 225 million square kilometers is reserved for mankind as a whole and will be administered by an international organization on its behalf.

VI. Congressional Record Report on Sea Citizenship

December 10, 1974

Mr. President, today, Human Rights Day, I would like to bring to the attention of my colleagues in the Senate and my fellow Americans everywhere the formation of an international organization that will be devoted to the stewardship of the sea. Like the Earth Society, which founded Earth Day and sought to heighten awareness among our citizenry for the environmental destruction going on in our land, the Sea Citizen Organization will seek to focus our attention on an environmental matter that should be of direct concern to us all--the threat to the global sea and to the stake each one of us has in the resources of the sea.

The founding principle of the Sea Citizen Organization is the affirmation that the world ocean is the common heritage of mankind, and not the special province of the coastal nations or those business enterprises most technologically able to exploit the resources of the sea. We all own the sea. We all have a tremendous stake in its future. We, the people of the world, have a right to demand responsible management of the sea resources.

The Sea Citizen Organization will promote formation of an international sea authority which will establish the kind of guidelines that will insure the access of future generations to the bounties of the sea. Without coordinated international attention, the ocean and its resources will become despoiled. This is already happening. Sea Citizens will try to sound alarms before it is too late. They will try to focus public pressure on governments and corporations to stop destructive exploitation of the sea.

Nations are failing to control the pollution that threatens the estuaries and shallow coastal waters where sea life is most abundant and where the reproductive cycle of many fish and other sea animals is carried out. Coastal countries are failing to stop the destruction of natural wetlands that support sea birds and shellfish. The fishing fleets of many nations are overtaking the ability of many sea species to regenerate. It is clear that these problems are global in scope and need cooperative multinational solutions.

I vividly recall the testimony of Thor Heyerdahl before the Senate Commerce Committee following his Ra I and Ra II voyages several years ago. He demonstrated in those Atlantic expeditions, and in the Pacific Kon Tiki expedition before them, that our concept of "territorial water" is very mistaken. The world ocean, he said, is a large sink with no drain. Into the sink flows most of the world's pollution, and none of it leaves. It only swirls around with the ocean currents that ultimately distribute it to all reaches of the global sea. Pollution dumped into the territorial waters of Japan often reaches the west coast of the United States; Moroccan pollution reaches the Caribbean, as Ra II demonstrated; Peruvian pollution reaches Polynesia, as Kon Tiki demonstrated.

The inescapable conclusion is that whatever one nation does with its territorial waters affects other nations, other people, and, in fact, the whole world ocean. The people of the world who fear for the future of the ocean must somehow influence these countries' governments, and the Sea Citizen Organization affords them the opportunity.

The members of the Sea Citizen Organizing Committee are Mr. John McConnell, founder and president fo the Earth Society; His Excellency Dr. Arvid Pardo, former chairman of the U.N. Seabed Committee; Mr. Harold Taylor, former president of Sarah Lawrence College and chairman of the U.S. Committee for the United Nations University; Mr. Frank Braynard, general manager of Operation Sail '76 and author of eleven books on the sea; Ms. Louise Eggleston, former president of the International Literacy Foundation; and myself. Today we are presenting the first Sea Citizen Certificate to a young student of the United Nations International School at a ceremony in New York.

Mr. President, I ask unanimous consent to have the Sea Citizen Declaration printed in the RECORD following my remarks. I urge all who can subscribe to the principles of this declaration to support this organization and become Citizens of the Sea.

There being no objection, the declaration was ordered to be printed in the RECORD, as follows:

SEA CITIZEN DECLARATION

(Statement by Sea Citizen Organizing Committee)

We affirm that the global sea, the common heritage of mankind, and the last refuge from the multitude of national territorial restraints, should be protected and made freely available to the present and future people of Earth, in order that the bonds of spirit engendered by the sea may bring understanding that will mitigate the divisions found on land.

Indeed, ancient beliefs in the brotherhood of those who went down to the sea, their fierce love of freedom and tradition of freedom of the seas, are a common bond between ancient and modern sailors, fishermen, those who now explore the ocean depths, and Sea Citizens.

We urge action by the United Nations, and by all concerned organizations, to protect the sea from man-made pollution; to protect its great whales and porpoises, its many-hued fish, shellfish, and plants, its tiny organisms, and multiform varieties of life which for billions of years, borne by its currents, enjoyed the marine environment on which the whole web of life on Earth depends.

We urge education, developmental guidelines, and essential environmental regulations be provided by the United Nations to encourage careful stewardship and management; in the harvesting of fish, sea plants, and other marine sources of protein for the world's hungry; in the protection of individuals and nations that depend on the sea for their living; in obtaining oil and minerals from the seabed; in the operation of ships that ply the sea. We support programs that will preserve for future generations the healing balm of clean salt water and blue seas, with their benefits to the mind, body, and spirit, and to all who swim, sail, or fish.

We seek recognition of the sea and its bed as the common heritage of mankind, and affirm that the borders of the sea shall extend to the highwater mark and to the farthest reach of brackish waters in rivers, inlets, and bays. Management of coastal resources (fish, seaweed, oil, minerals) should conform to guidelines established by a global sea authority. These guidelines should set forth how nations can best take responsibility for the care and protection of adjoining tidelands. Efforts to expand national sovereignty further into the sea by increasing navigation and economic boundaries, should be taken as an encroachment on the rights and property of all Sea Citizens, and all Earth's children, as a threat to the wholeness and future of the sea.

We support the formation of an International Sea Authority, with appropriate safeguards to national and individual interests, which will safeguard the common heritage of the sea for the benefit of all Earth's life, and which will license against appropriate fees major activities in the marine environment in order to prevent wasteful exploitation of resources and to minimize environmental deterioration. We support the efforts of the Earth Society to establish a clearinghouse of information for Sea Citizens.

We invite people everywhere to register with the Sea Citizen Organization and thereby to express their desire to protect the sea and their claim to equal ownership and shares in the bounty of the sea, the "common heritage of mankind."

MR. OR MS. RUPERTSON

You are from the United States. Your position is that either no controls or the very minimum of controls should be placed over mining operations on the ocean floor. You hold this position because you firmly believe in the free market system--anyone should be able to go into business to try and make a profit with no outside controls. You were very poor as a child but were able to start your own company, make a profit, and become a rich, successful businessperson. You therefore believe America is the greatest country on earth because of the free market system. Any controls over seabed mining would limit the chances for a large profit; this would make it hard to find investors.

Using the free market system to run seabed mining would allow many nations to profit. These countries, like the United States, would then be able to help poor nations. The world needs the important minerals on the sea floor, so it shouldn't make it hard for companies to get them. Besides, profits made by U.S. companies would help our economy grow. No controls over seabed mining are best for individuals, society, and the whole world.

MR. JACOBUCCI

The United States is your home, even though you travel all around the world on business. Because you have traveled so much, you can honestly say that the United States is the greatest country on earth. The United States leads the fight for freedom against the Soviet Union and such forces as the oil-exporting countries, who are trying to bleed the world dry through higher and higher oil prices. You therefore favor no international controls over seabed mining. The ocean floor is a place where U.S. companies can lead the world in finding and bringing back important mineral resources. International controls would slow the United States down, creating another situation in which poor, small countries could "get us over a barrel" with high prices for minerals. We have led the world because we have the best system of government and economy. Isn't it about time we said "enough!" to the demands of other countries and acted like a true leader? Getting those minerals off the ocean floor without any controls will let us truly be a leader in the years to come.

MS. HERNANDEZ

As head of the World Tech Corporation, you are one of the most powerful women in American business. Your company has built rockets that have gone to the moon and submarines that travel the oceans. World Tech is now designing devices to be used in mining the seabed. Because you want to sell this machinery now, you favor no controls over seabed mining. The only control you could accept would be issuing of a license to mine. If lots of controls were set up, sales of machinery would go slowly while companies met all of the regulations.

With no controls over seabed mining, companies could move ahead quickly to mine the nodules. This would mean higher U.S. employment, growth in our economy, and greater profits for World Tech.

MR. SEIDEL

You were born and raised in Bonn, West Germany. You now work for BRG, a huge German mining company with mines around the world. Of course your company wants to mine the seabed; it's "just another mine" to you. BRG has always had to live with controls over its mining operations. These controls were for safety, wages, and the environment. Though they were sometimes annoying, these controls never really caused major problems. Therefore you are willing to accept minimum controls over seabed mining, but no strong controls. Anything beyond the minimum controls would hamper your getting these necessary minerals off the ocean floor.

Seabed mining by private corporations is the only way to go. These companies have the ability to really make the system work. The companies would need port facilities, warehouses, processing plants, and a thousand other things that could be located in developing countries. This would help their economies without giving them handouts. Why, the metals brought up could even be sold to developing countries to help them build up their industries. Any major controls would just slow this process.

MR. NAKAGAWA

As the president of a major Japanese bank, you favor the absolute minimum of control over seabed mining activities. Your reasons are simple and clear. You have already invested millions of dollars in ocean mining activities and plan to invest more. Your profit and the safety of your investments depend on the rapid mining of the seabed by private companies. Any controls would slow this process and make your investments much riskier. You, and the many bankers you represent, favor a totally free market system. You could, however, accept a licensing arrangement in which a small percentage of the profits goes to an international fund to help poorer nations. Such a system would help those countries who are desperately in need of aid without hurting your investments.

Finally, as a citizen of an island nation, you know the danger of pollution in the ocean. Experts working for your bank have assured you that no harmful environmental effects will come from seabed mining. In fact, some research shows that seabed mining stirs up food needed by fish, thus making them feed in new places. This might be an extra plus for seabed mining.

MS. DUPUY

You are a French government official. Your country has a major interest in this issue because French companies mine 20 percent of the world's nickel in New Caledonia in the South Pacific. You want to be involved in seabed mining, too, because it will help you protect the prices French companies receive for nickel from New Caledonia. Therefore, you want a minimum of international control over seabed mining. Your reasoning is quite simple and logical:

--France has a large interest in keeping mineral prices high because it is a major mineral supplier.

--Seabed miners will want to keep mineral prices relatively high to protect their investments and get back the huge costs of seabed mining.

--The International Enterprise would try to lower metal prices to help developing countries while still protecting the poor countries who now supply metals.

--France is not likely to be protected because it isn't a poor country.

Therefore, private corporations, including French ones, should be allowed to get the metals from the ocean floor without stiff international control.

MR. OR MS. HYNES

A U.S. citizen, you are one of the heads of Ocean Floor Ventures, a pioneer of deep-sea mining. You have already claimed parts of the ocean floor and are doing test mining right now. You want no controls over seabed mining and think many of the arguments for controls are nonsense.

Corporations like yours believe the oceans are the "common heritage of mankind." You're making the seabed productive now. You make the "common heritage" idea come to life by providing jobs and money (through taxes) to poor countries. There are big bucks to be made on the ocean floor, and controls would just slow everyone down. You feel it is unfair to punish companies like Ocean Floor Ventures for taking the risk and going into a new area like seabed mining.

Finally, the ocean is a huge place. How can anyone possibly be worried about pollution? All you do is take material from the ocean floor and throw the excess back to settle. What could be harmful about that?

MS. MESSIMER

You are from England. You believe there should be no more than an absolute minimum of controls placed over seabed mining activities. Your reasons are crucial. The nodules on the seabed contain metals that are necessary for modern industry and the military. For example, those metals are important in making steel used in jet engines. Right now, western countries depend on unstable third-world countries for their supply of such metals. An alternative supply is needed now. Any controls beyond a simple licensing arrangement would slow this process down. Countries like England, West Germany, and the United States need a secure (safe) and stable supply of minerals. Allowing our corporations to get them is the best way of doing so.

MR. OR MS. SMORGRAV

You are from Norway. You strongly believe that the free market system has some strong advantages and some equally strong disadvantages. The free market system does encourage corporations to go out, perform a service such as mining the seabed, and make a profit. On the other hand, the free market system also encourages pollution and exploits those who are weak by keeping profits up. Therefore, while you support minimum controls, you do see some problems.

MR. OR MS. MAPANGO

Your home is the African country of Zaire. Zaire is extremely poor and is a producer of cobalt, one of the metals found in nodules on the seabed. It hurts to admit it, but your country has little ability to set world metal prices. When prices are up, you do well; when they are down, your people truly suffer. Therefore, you want extremely strong controls over seabed mining and an actual International Seabed Mining Enterprise to do the mining. These steps are needed to keep cobalt (and other metal) prices high enough for your country to grow.

Corporations care only for their profits and nothing for countries like Zaire. You want the biggest, strongest club possible to control these corporations and the powerful industrialized nations. The ocean floor belongs to all people in the world; this must never be forgotten. Strong controls would force corporations to mine cleanly and at a reasonable rate. Control would also ensure that the bulk of the profits go to the poor people of the world. An International Seabed Mining Enterprise would eventually let all nations mine the seabed for the benefit of all nations.

Role Card FK-11

MR. BHARTIA

You are from the landlocked developing country of Nepal. Your country is very poor and needs money to feed its people and start industries. As a landlocked, poor nation, Nepal has never had any voice in either international or ocean concerns--but that can now change. You support strong controls over seabed mining activities and the formation of an International Seabed Mining Enterprise. These actions would really make the seabed the "common heritage of mankind," instead of just another mine for a huge corporation.

Countries like Nepal used to be at the mercy of powerful nations. That can all begin to change with the right decision on seabed mining. The nodules on the seabed are not there just for the taking by those who get there first. Instead, the nodules should benefit all people. Strong controls would keep corporations from being too greedy, and an International Seabed Mining Enterprise would engage all nations--rich or poor, coastal or landlocked--in the exciting business of seabed mining.

MS. UHURU

Tanzania, your home country, was one of the African territories "raped" by giant colonial corporations in the past. The countries and companies, each very powerful, took your mineral wealth and gave you almost nothing in return. To make it worse, they always said that they were just trying to help you. Nonsense!! To avoid repeating this tragic story, you support super-tough controls on seabed mining and immediate creation of an International Seabed Mining Enterprise to take over all seabed mining. As the representative of a developing country, you believe all such countries must stick together to control corporations and industrialized countries. You must do this even if it means that the minerals remain on the seabed a bit longer. If no controls are placed on seabed mining, the evils of the past will be repeated.

The danger can be seen in what some people have said: "Sure, have an International Enterprise scoop the nodules off the seabed, but then let others process them" This sounded great until you realized that only 6 to 10 percent of the value of seabed mining comes from getting minerals off the ocean floor. Others would get 90 to 94 percent of the value! You say: NO WAY!

If the seabed is truly the "common heritage of mankind," everyone must wait until more countries can participate in seabed mining. Only strong controls and an International Enterprise that carries out all steps of seabed mining can make sure that justice prevails.

MR. OR MS. CASTANEDA

You are from Mexico. You favor very strong controls over seabed mining so that the wealth can be fairly spread around. For example, your country would be a fine place to locate a nodule-processing plant, which would help its industry and employment situation. With strong controls, seabed miners could be forced or encouraged to locate a plant in Mexico. Many other countries could benefit in the same way. A strong set of controls would ensure that good wages are paid, royalties are provided, the environment is protected, and so on.

Mexico eventually plans to become a seabed mining country. Controls would make sure that powerful countries and corporations don't gobble up the minerals, leaving none for future miners. Strong controls would control the rate at which the nodules are mined so all benefit now and in the future.

MS. BALA

Many people don't realize that India, your home, is starting to develop many new industries. These industries are creating a strong demand for many metals. The ever increasing and fluctuating prices of metals thus mean problems for your country. Although the seabed could provide a stable source of minerals, India is in no position now to engage in seabed mining. The solution is extremely strong controls over present miners and the start of an International Seabed Mining Enterprise. The growth of industry in India will take quite a while and strong controls would ensure a stable supply of metals at reasonable prices for years to come. An International Enterprise would start mining the seabed on behalf of the developing countries. Only tight controls will ensure future prosperity for poorer nations.

MR. YASSINE

You are from Algeria and you are angry! Your country suffered terrible exploitation while it was a colony. You have vowed never to let such evil happen again. Corporations and powerful countries will take everything they can lay their greedy hands on, no matter what lovely things they may say. The developing nations must demand strong controls and a powerful International Seabed Mining Enterprise that would eventually take over all seabed mining. You have two main arguments for this position. First, you truly believe in the ideas of the New International Economic Order that promotes justice for all people and countries. Strong controls and an International Enterprise would be a major step toward creating this new "order." Second, the common heritage of mankind means just that--these minerals are for Algeria just as much as they are for the United States or Germany. Only strong controls will allow Algeria to get its fair share--including the technology and investments necessary to engage in seabed mining.

Role Card FK-16

MR. OR MS. WINTER

You are an environmentalist living in Hawaii. Although you are a U.S. citizen, your position certainly goes against the opinions of many Americans. You favor extremely strong controls over all seabed mining, whether it is done by corporations, the International Seabed Mining Enterprise, developing countries, or some other method. You fear pollution of the oceans. Mining activity will pour millions of tons of sludge into the ocean. Processing plants will have dangerous "tailings" and chemicals to contend with. A strong authority and controls will be the best protection for the source of all life--our oceans. You remember how New York dumped its garbage into the ocean thinking it would just go way. Now, a whole area of the ocean off New York is dead. We can't repeat such a mistake when seabed mining gets going.

MR. PAL

You are from the small, extremely poor country of Bangladesh. Your country needs funds for development--to feed children, build schools and roads, improve agriculture, and start industry. Strong controls over seabed mining are the best way to bring in money from the corporations. This money can then be distributed to countries such as yours. Realistically, you will never be a seabed mining country, so these development funds would provide you with the benefits from exploiting the ocean floor. Strong controls would do the most to protect developing countries. The suggested license arrangement would bring in only the tiniest amount of money to aid poor countries. You want to make the "common heritage" principle start feeding people and building schools through strong controls over seabed miners.

MR. OR MS. DELGADO

The government of Argentina, your home, is very active in controlling that nation's economy. At the same time, your country has a very strong free market system.

You believe that the seabed really does belong to all people. However, you also realize that the corporations have the necessary technology and money to start getting the nodules off the ocean floor. Therefore, you are looking for some kind of compromise that would allow both the corporations and the rest of the world to benefit. Too-strong controls would stifle the efforts of corporations, while too-weak controls (or none at all) would sacrifice all that the developing nations are seeking.

MR. WILSKI

Your home country is Poland, a country that is trying to develop its economy.

You support the claims of the developing countries who believe the seabed minerals are the "common heritage of mankind." Those minerals aren't just there to be taken by the powerful corporations of the Western Hemisphere. However, you know that unless corporations are allowed to freely mine the seabed now, no money will be available to aid poor nations. Some compromise system is needed that would control the corporations while protecting the interests of the developing nations. Such a system could also control environmental damage because corporations would have to follow reasonable rules when mining.

MS. TEDESCO

Your country, Italy, is a member of the European Economic Community, better known as the Common Market. Italy supports the ideas of the New International Economic Order as a pattern for the future of the world's people. The New International Economic Order says that developing countries must have a strong say in such areas as seabed mining. However, carrying that idea too far might mean that nothing would be done about seabed mining for a long time. The metals are too important to delay mining them. Therefore, you think a system needs to be established whereby private corporations mine under realistic controls established by the formation of an International Seabed Mining Enterprise.

Such a system would be a compromise because it would keep the interests of developing countries in mind. The corporations would not be free to do whatever they pleased. However, they could mine, pay royalties, and help supply important strategic metals. Meanwhile, the International Seabed Mining Enterprise would be mining on behalf of the nations of the world, supplying them with metals and money.

MR. OR MS. KOH

You are the head of the First Committee of the Law of the Sea Conference on Mining the Seabed. You are from Singapore, a developing country that is still relatively poor. Although you would normally side with countries like your own, you have been ordered to create a compromise. This is your goal, even if it means sacrificing certain national interests. However, you will vote for the solution that is presented with the strongest evidence. To help you decide, you want answers to the following questions:

--What is the "common heritage of mankind" argument, and how does it relate to the debate over mining the seabed?

--What is the New International Economic Order?

--Will pollution be a problem in mining the seabed and processing the minerals?

MR. SAMSON

You represent Canada, a large industrialized country that is also a major producer of nickel. Nickel is one metal that will be found in nodules brought up from the seabed. You seem to sympathize most with the industrialized countries and corporations. However, you hope to help create a model for developing countries. Your decision will be based on the strongest arguments and best evidence presented. Answers to these and other questions will help you make a quality decision:

--Which solution being proposed will benefit the largest number of people?

--What are the benefits and drawbacks of the free market system?

--What is the best solution if getting money to poor countries is a major goal of mining the seabed?

MS. BUSTANI

Brazil is your home country. Overall, it would have to be said that Brazil is a developing nation, still far from doing anything like seabed mining on its own. You are tired of all the arguing, name-calling, and unproductive talk. The metals that can be gained through seabed mining are important, but the developing countries must not be cheated. Your decision will be based on the arguments that provide the best solution to the question of how best to control seabed mining. Good answers to these questions will be useful in making that decision:

--What metals exist in the nodules that would be mined?

--Are the metals from the seabed important, and how are they used?

--How much are these nodules worth?

MR. OR MS. PRIJONO

The country of Indonesia, your home, is a developing country and a producer of minerals such as nickel and cobalt. You have a very strong interest in how the debate over seabed mining turns out. You are impressed by the goals of the New International Economic Order, but you don't want to ruin your country's chance to later become a seabed miner. You are committed to protecting the interests of Indonesia and those of countries like it. Answers to these questions and strong evidence from the various groups will help you make a good decision:

--What methods are used in mining the seabed?

--What would happen without strict controls over corporations that plan to mine the seabed?

--What are the concerns of those countries that now mine and sell metals like those found on the seabed?

MS. LUNGU

The country of Zambia, your home, is both landlocked and poor. You have never had any real benefits from the world's oceans and are excited about the treaty governing seabed mining. Your nation needs money badly to continue its development efforts. Therefore, you will listen carefully to the various arguments. looking for the solution that will bring the most money into your country. You will insist on good evidence, clear arguments, and answers to these and other questions:

--What would happen if weak or no controls were placed over seabed miners? What about strong controls?

--How would the International Seabed Mining Enterprise work?

--How have poor countries with valuable minerals been treated by richer, more powerful countries and corporations in the past?

MR. BAILEY

Australia, your home, is a coastal developed country with a good, strong economy. Probably the most important issues for you have to do with pollution and the environment. You want good answers on environmental questions because your country could really be harmed if an accident occurred. You see the needs of both the developing and industrialized countries, as well as those of the corporations. Because of this, you want good answers to these questions, with powerful evidence and arguments:

--What are the environmental hazards of mining, transporting, and processing seabed minerals?

--Are there corporations willing and able to mine the seabed soon?

--Can state control and private enterprise work together?

MR. OR MS. IVANOV

You represent the Soviet Union and speak for many countries allied with your nation. You produce huge amounts of minerals such as nickel, but use most of them in your own industry. You strongly support the goals and arguments of the developing nations. On the other hand, you don't want to block the Soviet Union's future entry into seabed mining with too many regulations. You must therefore listen to the debate and seek good answers to these and other questions:

--How would weak or no controls benefit poor and developing nations?

--How do corporations see themselves respecting the "common heritage of mankind"?

--Is there any way of ensuring that the nodules won't all be picked up now, leaving no chance for future mining?

ADDITIONAL RESOURCES

TEXTBOOKS AND SUPPLEMENTARY PRINT MATERIALS

Acid Precipitation Awareness Project. St. Paul, MN: Acid Rain Foundation, 1985.

Six packets of materials in this program are suitable for use in natural and social science courses. Each contains classroom activities, overhead transparencies, tests, and bibliographies.

Annual Editions: Environment 84/85. Guilford, CT: Dushkin Publishing Group, 1984.

This volume offers 35 up-to-date articles on current environmental issues. Articles from newspapers, professional journals, popular magazines, and books cover population and the environment, energy, pollution and growth issues, resources conservation, and endangered species.

Bender, David, and Richard Mahen, eds. Opposing Viewpoints Series: Science and Religion. St. Paul, MN: Greenhaven Press, 1982.

Each volume in the Opposing Viewpoints Series contains articles written from various and often conflicting perspectives on a given issue. Each volume contains a bibliography and student activities.

Biological Sciences Curriculum Study. Innovations. The Social Consequences of Science and Technology Program. Dubuque, IA: Kendall/Hunt Publishers, 1984.

Five modular volumes--Biomedical Technology, Computers and Privacy, Television, Science, Technology, and Society, and Human Reproduction: Social and Technological Aspects--cover issues in science, technology, and society that have significant implications for public policy. Each volume contains readings, discussion activities, and homework assignments on "hot topics" of science and society. Material is suitable for a one-semester interdisciplinary course in science or social studies.

Brown, Lester, et al. State of the World 1985. Washington, DC: Worldwatch Institute, 1985.

This publication covers a number of STS issues from a global perspective.

Iozzi, Louis, et al. Preparing for Tomorrow's World. Longmont, CO: SOPRIS West, Inc., 1982.

The program contains ten interdisciplinary, future-oriented modules suitable for use in science or social studies classes. The modules are Environmental Dilemmas, Dilemmas in Bioethics, Coastal Decisions: Difficult Choices, Energy: Decisions for Today and Tomorrow, Future Scenarios in Communication, Of Animals, Nature, and People, People and Environmental Changes, Perspectives on Transportation, Technology and Changing Lifestyles, and Technology and Society. The program promotes responsible citizenry with increased abilities in critical thinking, problem solving, social/ethical reasoning, and decision making. Each volume introduces students to a sample of science-related social issues through readings and "dilemmas." Teacher's guides contain background information and rationale.

National Issues Forum. Difficult Choices About Environmental Protection, The Soaring Cost of Health Care, and Nuclear Arms and National Security. Dayton, OH: Domestic Policy Association, 1984.

Materials in these three volumes are intended as a guide to public debate on policy issues that have been prominent in the news. Each volume contains a pre-forum questionnaire, four to five readings covering both pros and cons of the issue, a bibliography for further reading, and a materials order form.

Taking Sides: Clashing Views on Controversial Environmental Issues. Guilford, CT: Dushkin Publishing Group, 1984.

A point/counterpoint format is used to provide students with varying perspectives on environmental concerns. Contents are divided into sections on general, philosophical, and political issues; the relationship between environment and technology; and the future of the environment. Specific issues covered in these sections include environmental regulation, wildlife, risk/benefit analysis, population control, nuclear power, the use of pesticides, industrial chemicals and cancer, acid rain, safe drinking water, climate changes, pollution, and resource depletion.

Williams, Charles F., et al. Technology for Tomorrow. Cincinnati, OH: Southwestern Publishing, 1985.

A textbook suitable for a future studies, career awareness, general social studies, or interdisciplinary science and society course is divided into five parts treating technology and change, physical technology, and technology at work.

MULTIMEDIA MATERIALS

Eco-Paradise. Washington, DC: Center for Science in the Public Interest, 1983.

A three-part software program helps students become more aware of ecological issues and their own personal contribution to the health of the environment. The program includes a quiz game focusing on current environmental problems, a test which rates students on how consistent their lifestyles are with sound environmental practice, and a section which lists sources of additional information. Topics covered include toxic waste dumps, air and water pollution, soil erosion, the benefits of organically grown foods, and plant and animal extinction.

Harrisburg. Oley, PA: Bullfrog Films, 1980.

This 20-minute black-and-white film provides an impressionistic account of the nuclear accident at Three Mile Island. Based on television, radio, and newspaper coverage, it conveys the confusion and contradictory statements that characterized this first experience with a nuclear accident.

In Our Own Backyard: The First Love Canal. Oley, PA: Bullfrog Films, 1982.

This one-hour film presents footage of public events and interviews with the participants in those events to examine the ways Love Canal residents, their scientific and legal advisors, and government officials understood and responded to developments at the Love Canal between 1978 and 1980.

Issue: The Nuclear Freeze Controversy. Old Greenwich, CT: Listening Library, Inc., 1983.

Students learn the history of the nuclear freeze movement in this presentation. They witness the severe polarization of pro- and anti-nuclear groups. The roles of government agencies and grass roots movements in this controversy are also explored.

Nuclear Power Today and Tomorrow. Madison, WI: Hawkhill Associates, Inc., 1984.

This program provides students with the necessary basic information about nuclear reactors, their potential, and their danger. A summary reviews the pros and cons of nuclear power, both present and future.

Our Drinking Water: A Closer Look. Washington, DC: U.S. Environmental Protection Agency, 1981.

This 30-minute film examines the pollution of drinking water by chemicals. Also examined is groundwater contamination from waste disposal leakage.

Radiation: Impact on Life. Oley, PA: Bullfrog Films, 1982.

This film details the effects of high levels of radiation on the body, using eyewitness accounts and newsreel footage of Hiroshima after the bomb. It then explores the controversy concerning low levels of radiation from sources such as x-rays and normally operating nuclear power plants. Three experts--a past chairman of the National Committee on Radiation Standards, a leading physicist, and a professor of medical physics--are interviewed.

Rewiring Your World. Washington, DC: Communications Workers of America, 1985.

Rewiring Your World, a TV series now available on video tape, contains four separate programs. The programs examine the implications of the telecommunications revolution on society--how it affects the way we work, live, play, and communicate. The first show provides an overview of the issues. Show two explores how work will change in an automated technological world and who wins or loses in the process. The third show reviews the changes wrought on our electoral process by new communications technology, while the final program explores the implications of the information age for business, labor, government, and educational planning.

Toxic Wastes Today and Tomorrow. Madison, WI: Hawkhill Associates, Inc., 1984.

This program provides students with basic scientific concepts they need to form intelligent opinions on the hazards of toxic wastes such as dioxins, PCBs, and asbestos. Basic concepts include the nature of chemicals and radiation, the cycling of chemicals in the biosphere, food chains, and tolerance levels in living organisms and the environment.

United States Energy, Environment, and Economic Problems. Iowa City, IA: Conduit Software, 1984.

Using this simulation, students study the formation of public policy through the interaction of the U.S. economy, energy supply and demand, and the physical environment. The model of public policy used in the simulation is composed of societal group and individual values and goals, government structures and processes, and the nonpolitical environment. After reading about methods of decision making presented in the package, students use the program to describe alternative energy/environment/economic decisions for the future. The program then reports the long-run consequences of these decisions.

TEACHER RESOURCES

The American Biology Teacher 44(September 1982).

A preconvention issue of this professional journal covers the theme of "The Biological and Social Sciences: Education for Citizenship." Articles by science and social studies teachers discuss the relationship between the two disciplines, ways to teach science and society issues in the classroom, and the imperative for citizenship education in both science and social studies classrooms.

Curriculum Review 24(January/February 1985).

A special issue of this journal focuses on science, technology, and society, and includes articles on helping children cope with high technology, exemplary elementary and secondary science and society programs, practical ways to teach science-related social issues, and a view of classroom resources.

Nelkin, Dorothy, ed. Controversy. Politics of Technical Decisions. Second Edition. Beverly Hills, CA: Sage Publications, 1984.

A collection of background readings, this publication contains articles on specific public policy issues related to science and technology as well as articles examining the benefits and risks of science-related public policy decisions, the role of government regulation in science, and the conflict between science and traditional values. Specific issues covered are an airport controversy, nuclear power, highway construction, toxic waste disposal, binary weapons, health hazards from vinyl chloride, laetrile, fetal research, recombinant DNA, and creation versus evolution.

Patrick, John, and Richard Remy. Connecting Science, Technology, and Society in the Education of Citizens. Boulder, CO: ERIC Clearinghouse for Social Studies/Social Science Education, and Social Science Education Consortium, 1984.

This publication offers analyses and approaches to the challenge of teaching about science-related social issues. Topics covered include challenges associated with science-related social issues, the extent to which these challenges are being met, ways in which educators can improve education in science/technology/society issues, and promising practices that can build connections between social studies and science curricula.

Patrick, John, and Richard Remy. Science-Related Social Issues: Challenges for the Social Studies. ERIC Digest No. 16. Boulder, CO: ERIC Clearinghouse for Social Studies/Social Science Education, 1984.

This brief fact sheet synthesizes the main issues covered in the SSEC/ERIC publication, Connecting Science, Technology, and Society in the Education of Citizens. Covered are the challenges of citizenship education in a technological age, a review of research on student attitudes and student knowledge of science and science-related issues, commercial textbook coverage of such issues in both science and social studies, and a summary of promising practices for teaching about science, technology, and society.

Peterson, Rita, et al. Science and Society. Columbus, OH: Charles E. Merrill Publishing Co., 1984.

A methods text for elementary, middle, and junior high school teachers organizes the science curriculum around six concepts which have social significance for all citizens. These are identity, organizations, interaction, change, limitations, and conservation. The book focuses on social implications and decision making, and includes activities.

Science and Society Committee of the National Council for the Social Studies. Guidelines for Teaching Science-Related Social Issues. Washington, DC: National Council for the Social Studies, 1982.

A position paper outlining the need for teaching science-related issues in the social studies precedes a series of guidelines for classroom coverage. Guidelines are divided into sections on choosing a topic and evaluating existing material, gathering information, processing information, evaluating information, problem solving, and evaluating and testing.

Social Education 17(May 1983).

A special issue of this journal focuses on technology and the social studies. Separate articles treat computers in the social studies classroom, interactive video systems, the effect of information technology on the social studies, and citizenship education software.

RELATED RESOURCES IN THE ERIC SYSTEM

The resources below are available through the ERIC (Educational Resources Information Center) system. Each resource is identified by a six-digit number preceded by two letters: "EJ" for journal articles, "ED" for other documents. Abstracts of and descriptive information about all ERIC documents are published in two cumulative indexes: Resources in Education (RIE) for ED listings and the Current Index to Journals in Education (CIJE) for EJ listings. This information is also accessible through three major on-line computer searching systems: DIALOG, ORBIT, and BRS.

Most, but not all, ERIC documents are available for viewing in microfiche (MF) at libraries that subscribe to the ERIC collection. Microfiche copies of these documents can also be purchased from the ERIC Document Reproduction Service (EDRS), 3900 Wheeler Avenue, Alexandria, VA 22304-5110. Paper copies (PC) of some documents can also be purchased from EDRS. Complete price information is provided in this bibliography. When ordering from EDRS, be sure to list the ED number, specify either MF or PC, and enclose a check or money order. Add postage to the MF or PC price at the rate of $1.55 for up to 75 microfiche or paper copy pages. Add $0.39 for each additional 75 microfiche or pages. One microfiche contains up to 96 document pages.

Journal articles are not available in microfiche from ERIC. If your local library does not have the relevant issue of a journal, you may be able to obtain a reprint from University Microfilms International (UMI), 300 North Zeeb Road, Ann Arbor, MI 48106. All orders must be accompanied by payment in full, plus postage, and must include the following information: title of the periodical, title of article, name of author, date of issue, volume number, issue number, and page number. Contact UMI for current price information.

ACTIVITY 1: HOT RODS

Abrams, Nancy E., and Joel R. Privnack. "Helping the Public Decide: The Case of Radioactive Waste Management." Environment 22(April 1980): 14-20. EJ 226 249. Reprint available from UMI.

This model encourages public participation in the review process at stages most appropriate to individuals' and groups' special interests and expertise. The authors suggest the outcome would be a high quality technical plan enjoying widespread public understanding and support.

Armstrong, Jennifer. "Why Teach Nuclear Power." Bulletin of Environmental Education 138(November 1982):5-9. EJ 275 142. Reprint available from UMI.

This article discusses reasons why nuclear power/technology should be taught. It indicates that the subject is not strictly science-

related, the issues offering material for lessons in geography, history, politics, and economics.

Barber, Jacqueline, ed. Nucleography: An Annotated Resource Guide for Parents and Educators on Nuclear Energy, War, and Peace. Berkeley, CA: Nucleography, 1982. ED 247 199. EDRS price: MF-$0.97/PC-$9.15 plus postage.

This selective annotated bibliography is intended for anyone who wants to learn and teach about nuclear technology and its potential implications for humankind. Over 600 resources dealing with nuclear energy, nuclear war, and peace are described in eight chapters. Appendices contain the names of contributors and the names and addresses of film distributors.

Beane, Marjorie. A Nuclear Power Primer: Issues for Citizens. Washington, DC: League of Women Voters, 1982. ED 277 030. EDRS price: MF-$0.97 plus postage.

The history, problems, arguments, and controversy concerning power created by nuclear fission are outlined. The purpose of the booklet is to present unbiased information for the layman in understandable language in order to improve the quality of national debate over nuclear power. Information for the booklet was gathered from journals, government reports, private institutions, academicians, and government commissions. The eight-chapter document discusses incidents leading to the current controversy over nuclear power, the formation of the UN Atomic Energy Commission, the Atomic Energy Act of 1946, and the establishment of the U.S. Atomic Energy Commission, which has exclusive control over production, ownership, and use of fissionable materials in the United States. Methods are outlined for measuring and judging risks when energy sources are compared. The safety factors of low and high level radiation; the necessity for improving safety systems; and reform needs in licensing, operations, and emergency plans are also discussed. A "short course" in nuclear reactors describes light water, breeder, and alternative reactors. Rising construction costs, financial constraints, and cheaper alternatives for utilities companies are presented as major economic factors. The final chapters consider the nuclear fuel cycle for uranium and plutonium, weapons proliferation, and nuclear terrorism.

Canipe, Stephen L. Trade-Offs In Our Energy Future. Raleigh, NC: Duke Power Company Educational Services Department, 1983. ED 230 364. EDRS price: MF-$0.97/PC-$2.15 plus postage.

The purpose of this activity is to make students aware that there is no free energy source for the present or the future and that all technologies are potential threats to the environment. The activity consists of a short reading (discussing basic trade-offs, issues, and decisions related to petroleum, coal, and nuclear energy sources) and student exercises. The key for students and decision makers is to pick the energy source least likely to be permanently harmful or the one that has the smallest total negative effect.

Fowler, John J. "Energy: The Surprising Decade." Science Teacher 50(March 1983):37-40, 45-47. EJ 278 516. Reprint available from UMI.

This article stresses the importance of energy education and discusses various aspects of and trends related to energy in the United States. These include energy costs, recession and energy conservation, the nuclear debate, environmental concerns (including acid rain), solar energy, technological developments, energy policy/politics, and projection of energy needs/concerns in the 1990s.

Iozzi, Louis A. Energy: Decisions for Today and Tomorrow. Teacher's Guide. Preparing for Tomorrow's World. New Brunswick, NJ: Rutgers, The State University, 1982. ED 230 372. EDRS price: MF-$0.97 plus postage.

Energy: Decisions for Today and Tomorrow is one of the Preparing for Tomorrow's World (PTW) program modules. PTW is an interdisciplinary, future-oriented program incorporating information from the sciences and social sciences and addressing societal concerns which interface science/technology/society. The program promotes responsible citizenry with increased abilities in critical thinking, problem solving, social/ethical reasoning, and decision making. This module, designed for grades 7-8 (social studies, general science, earth science, language arts, health education), examines issues underlying the "energy crisis" and values involved in decisions regarding such energy-related issues such as energy consumption, distribution, and sources. Subject matter is presented in three sections (oil and transportation, nuclear energy, and coal). The teaching guide includes an overview of the module (purpose; strategies employed, focusing on the dilemma/debate discussion techniques; module structure/objectives; and its use in the school curriculum) and instructional strategies related to the readings, dilemma discussions, and student activities in each of the three sections. A chart indicating moral issues (as defined by Kohlberg) presented in the dilemmas, suggested schedule of activities, and bibliography are also included. The module may be used as a separate unit of study, as a mini-course, or as a unit incorporated into existing curricula where appropriate.

La Porte, Todd R. "Managing Nuclear Waste." Society 18(July-August 1981):57-65. EJ 249 492. Reprint available from UMI.

Discussed are theoretical and methodological challenges presented to the social science community by large-scale radioactive waste management. Analysis, management, and decision making are considered.

Maxey, Phyllis F. The Desolate Desert Controversy: Should Presto Power Company Build a Nuclear Plant? Instructor's Guide (and) Student Materials. A Business-In-The-Classroom Lesson Plan. Los Angeles: Constitutional Rights Foundation, 1979. ED 238 817. EDRS price: MF-$0.97 plus postage.

This packet focuses on the complex and controversial topic of energy technology. In a five-day simulation, students play the roles of energy commission members and business, local, and public interest group witnesses who must determine whether to build a nuclear power plant in the desert surrounding a growing urban area. By gathering and analyzing information on nuclear power, providing and weighing testimony, and considering the options and consequences of various types of energy generation, students not only gain knowledge about this timely issue, but also have the opportunity to examine their own values and attitudes, and practice decision-making skills. Both teacher and student materials are provided.

Nash, Thomas J. "Nuclear Fuels." Geotimes 28(February 1983):28-29. EJ 276 916. Reprint available from UMI.

Trends in and factors related to the nuclear industry and nuclear fuel production are discussed. Topics addressed include nuclear reactors, survival of the U.S. uranium industry, production costs, budget cuts by the Department of Energy and U.S. Geological survey for resource studies, mining, and research/development activities.

Nuclear Power from Fission Reactors. An Introduction. Washington, DC: Department of Energy, 1982. ED 242 501. EDRS Price: MF-$0.97/ PC-$2.15 plus postage.

The purpose of this booklet is to provide a basic understanding of nuclear fission energy and different fission reaction concepts. Topics discussed are energy use and production, current uses of fuels, oil and gas consumption, alternative energy sources, fossil fuel plants, nuclear plants, boiling water and pressurized water reactors, the light water reactor fuel cycle, enrichment, reprocessing, the breeding process, breeder reactor design, the breeder reactor fuel cycle, and breeder reactors in the United States. Each topic is accompanied by an illustration or diagram to aid understanding. A section of additional information describes the history of nuclear power in the United States and nuclear plants throughout the world. A glossary defines basic terms used to describe the fission process, the fuel cycle, and nuclear reactors. This pamphlet is suitable for use with secondary school students.

Ravetz, J.R. "Risk Assessment--A Science in Controversy." Physics Education 17(September 1982):203-208. EJ 270 257. Reprint available from UMI.

This article discusses principle themes and issues of risk assessment, using examples from the "nuclear debates." It indicates that while an objective scientific core to decisions on risks exists, this is conditioned in its interpretation by inexactness, uncertainty, and value commitments. Also considered are risk assessment elements, risk quantification in real problems, and judgments about quantities in risk management.

Thomashow, Mitchell. "Know Nukes: A Model for Teaching Controversial Issues." Nature Study 37(March 1984):38-39. EJ 300 313. Reprint available from UMI.

Summarized is a nuclear power workshop that presented techniques useful in controversial issues education. An introductory exercise and an overview of propagandistic techniques related to self-deception, language, irrelevance, exploitation, form, and maneuver are included. An outline of workshop presentation is also included.

ACTIVITY 2: DESIGNER GENES

Geiger, Jon R. "Genetic Engineering. An Introduction to Two Special ABT Issues." American Biology Teacher 46(October 1984):365-372. EJ 307 462. Reprint available from UMI

The author discusses techniques involved in producing recombinant DNA. Also discussed are implications of the new genetic technologies and prospects for the future.

"Glossary." Science 209(September 1980):1435-1438. EJ 232 883. Reprint available from UMI.

Listed are informal definitions for 130 terms dealing with recombinant DNA research.

Iozzi, Louis A., et al. Dilemmas in Bioethics. Students' Guide. Preparing For Tomorrow's World. New Brunswick, NJ: Rutgers, The State University, 1980. ED 230 369. EDRS price: MF-$0.97 plus postage.

The purpose of this module is to introduce students (grades 10-11) to critical bioethical issues by considering moral dilemmas and knowledge of biomedical advances. The module is organized into 12 topic areas, each containing a dilemma story, introductory reading material, sample student responses, and questions. Dilemmas are essentially brief stories which pose a critical decision to be made by a main character. This decision revolves around conflicts between two or more moral/ ethical issues (as identified by Kohlberg) presented in the situation, and it is the moral/ethical implication that provides the thrust for student discussions. Preceding each dilemma are relevant readings or case studies providing basic background information regarding the bioethical issue presented in the dilemma. Questions and sample student responses (representing positions taken by typical students) serve to stimulate thinking about the issues and generating discussions. Issues examined include organ transplantation; kidney dialysis patient selection; drug experimentation; fetal research; human behavior control; mass screening for genetic disorders; the terminally ill; mass screening for psychological disorders; eugenics; infanticide; test tube babies; and recombinant DNA. The module may be used as a separate unit of study, as a mini-course, or incorporated into biology, genetics, civics, history, philosophy, anthropology, health, or family-living courses.

Jennings, Bruce D. An Annotated Bibliography of Teaching Bioethics in the Public Secondary School. Unpublished paper, 1982. ED 229 232. EDRS price: MF-$0.97/PC-$3.90 plus postage.

This study was conducted to identify bioethical topics of possible interest for a high school science curriculum, focusing on advantages and disadvantages of bioethical education and emphasizing the procedure to incorporate bioethics instruction into the secondary school science curriculum. Researched material is presented as an annotated bibliography, divided into three major sections. Annotations in the first section focus on current scientific issues concerned with social ethics. These include genetic engineering; recombinant DNA; cloning; artificial insemination and sperm banks; in-vitro fertilization; surrogate motherhood; population control; living, aging, dying, and human experimentation; environmental and energy issues; and phynylketonuira screening. Annotations in the second section focus on arguments, both pro and con, concerning bioethical education. Educational needs of teachers as well as an analysis of the treatment of bioethical issues in high school textbooks are addressed. Provided in the final section are annotations dealing with the methodology of incorporating bioethics into the science curriculum. In addition, innovative teaching techniques are identified. Among the results of the literature survey were findings that the majority of science educators favored teaching bioethical issues, although the rationale for teaching these varied. Preparation for future decision-making skills was seen as an important argument for educating students about values and bioethics.

McInerney, Joseph D., et al. Biomedical Technology. Innovations: The Social Consequences of Science and Technology Program. Boulder, CO: Biological Sciences Curriculum Study, 1984. ED 249 074. Not available from EDRS.

This module is part of an interdisciplinary program designed to educate the general citizenry regarding the issues of science/technology/society that have important consequences for both present and future social policies. Specifically, the program provides an opportunity for students to assess the effects of selected technological innovations in order to make intelligent decisions about them. This module, which focuses on issues related to biomedical technology, consists of an introductory activity (examining changing patterns of sickness and death) and five additional activities, each consisting of two or more parts. These activities address issues related to: (1) public understanding of biomedical science, (2) genetic screening, (3) in vitro fertilization and embryo transfer, (4) prenatal diagnosis (including why amniocentesis is done), and (5) recombinant DNA. All activities include a list of goals, procedures for tasks to be accomplished, discussion questions, and suggestions for further study. When applicable, student readings are included.

Moore, John W., and Elizabeth A. Moore, eds. "'Genetic Engineering' Gains Momentum (Science and Society Case Study)." Science Teacher 47(April 1980):33-34. ED 232 883. Reprint available from UMI.

This article reviews the benefits and hazards of genetic engineering, or "recombinant DNA" research. Federal safety rules issued by the National Institute of Health which ease the strict prohibitions on recombinant DNA research are explained.

Teich, Albert H., and Ray Thornton, eds. Science, Technology, and the Issues of the Eighties: Policy Outlook. Westview Special Studies in Science, Technology, and Public Policy/Society. Washington, DC: American Association for the Advancement of Science, 1982. ED 229 257. EDRS price: MF-$0.97 plus postage.

Recognizing that science and technology (S/T) have become increasingly relevant to important public policy issues, Congress has mandated the periodic preparation of a "Five Year Outlook for Science and Technology" to help U.S. policymakers anticipate and deal with these issues more effectively. This book, the result of a study conducted by the American Association for the Advancement of Science for the second such "Outlook," identifies and explores domestic and international policy concerns in which science and technology are critical factors. The interdisciplinary, non-technical approach provides policymakers, students, and others interested in science, technology, and public affairs with a timely overview of areas that are likely to become the world's most pressing concerns during the next several years. Issues and areas addressed include: applying S/T to public purposes; institutional climate for innovation in industry; decision making with modern information and communications technology; relation of science, government, and industry (focusing on recombinant DNA); risk assessment for the 1980s S/T and international security; U.S. policy toward scientific and technological development in developing countries; U.S. agriculture in context of the world food situation; trends and prospects in world population; international security implications of materials and energy resource depletion; and science and national defense.

Vigne, Charles L., and William G. Stanziale. "Recombinant DNA: History of the Controversy." American Biology Teacher 41(November 1979): 480-483. EJ 213 290. Reprint available from UMI.

The hazards associated with recombinant DNA research are presented along with some social implications and the development of recombinant DNA research guidelines by the National Institute of Health.

ACTIVITY 3: RAINY DAY BLUES

"Acid Rain Students Do Original Research." *Outdoor Communicator* 15 (Winter-Spring 1984):3-6. EJ 298 613 Reprint available from UMI.

At Park Senior High School in Cottage Grove, Minnesota, 46 juniors and seniors planted 384 red pine seedlings in connection with their original research on acid rain, with advice from Dr. Harriet Stubbs, director of the Acid Precipitation Awareness Program in West Saint Paul, which has been developing acid rain teaching materials.

Acid Rain: What It Is--How You Can Help. Washington, DC: National Wildlife Federation, 1983. ED 248 102. EDRS price: MF-$0.97/ PC-$2.15 plus postage.

This publication discusses the nature and consequences of acid precipitation, commonly called acid rain. Topic areas include: (1) the chemical nature of acid rain, (2) sources of acid rain (3) geographic areas where acid rain is a problem, (4) effects of acid rain on lakes; (5) effect of acid rain on vegetation, (6) possible effects of acid rain on humans, (7) economic losses related to acid rain, and (8) a possible solution (suggesting that the pollutants causing acidity be controlled). Comments from the National Academy of Sciences on the acid rain problem, proposed federal legislation related to the growing environmental threat posed by acid rain, and information on what individuals can do to help control acid rain are included.

Bybee, Rodger W. "Human Ecology: Acid Rain and Public Policy." *American Biology Teacher* 45(April-May 1983):211-216. EJ 281 673. Reprint available from UMI.

This article introduces a human ecology theme and relationships between acid rain and public policy. Considered are scientific understanding and public awareness, scientific research and public policy, and national politics and acid rain.

Bybee, Rodger, et al. "The Acid Rain Debate." *Science Teacher* 51 (April 1984):50-55. EJ 300 340. Reprint available from UMI.

Described is an activity which provides opportunities for role-playing as industrialists, ecologists, and government officials. The activity involves forming an international commission on acid rain, taking testimony, and, based on the testimony, making recommendations to governments on specific ways to solve the problem. Included are suggestions for classroom applications.

Factor, Lance, and Robert Kooser. *Acid Rain Materials for Classroom Use*. Washington, DC: National Endowment for the Humanities, 1983. ED 247 133. EDRS price: MF-$0.97/PC-$3.90 plus postage.

This booklet contains three separate papers suitable for use in an advanced high school or college chemistry course. The first paper provides background information on acids and bases. The second paper provides additional background information, focusing on certain aspects of atmospheric chemistry as it relates to the acid rain problem. An attempt was made to keep the material as simple as possible and to provide enough vocabulary to understand the arguments of the experts, but not to overwhelm the student with the chemical details of the process. The third paper, which focuses on the acid rain controversy, consists of a number of exercises in a self-instructional format. The paper can be used either as a classroom activity in which students respond to the questions or as a model from which teachers can develop their own materials either on acid rain or some other topic of interest. Several suggestions are offered if teachers decide to use the exercises in a classroom setting. In addition, a list of discussion questions to extend various exercises and questions posed in the textual material are included.

Jackson, Reiner, ed. "Canadian Environmental Issues in Perspective." Environmental Education and Information 3(July-October 1984):187-195. EJ 317 351. Reprint available from UMI.

This article traces Canada's conservation practices and environmental concerns from settlement to the present. The relationship between Canada and the United States on several issues is discussed. Acid rain, water resources, toxic substances, natural resource management, energy consciousness, environmental impact statements, and increased public awareness are addressed.

Marion, James I. "Acid Rain: An Educational Opportunity?" Outdoor Communicator. 15(Winter-Spring 1984):7-13. EJ 298 614. Reprint available from UMI.

The author deals with how educators can handle the subject of acid rain; illustrates suggestions with experiences of grade nine students visiting Frost Valley Environmental Education Center (Oliverea, New York) to learn scientific concepts through observation of outdoor phenomena, including a stream; and discusses acid rain, pH levels, and pollution control measures.

Postel, Sandra. Air Pollution, Acid Rain, and the Future of the Forest. Washington, DC: Worldwatch Institute, 1984. ED 242 521. EDRS price: MF-$0.97 plus postage.

This book traces centuries of human use and abuse of forest ecosystems by discussing past decades of intense burning, grazing, and timber cutting that added to the natural acidification of the soil. Air pollutants and acids generated by industrial activities worldwide are also considered. Many forests in Europe and North America now receive as much as 30 times more acidity than they would if rain or snow were falling through a pristine atmosphere; ozone levels in many rural areas of Europe and North America are now regularly in the range known to damage trees. Major topic areas discussed include: (1) signs of forest destruction worldwide; (2) pathways of pollution that in most cases are traced back to sulfur and nitrogen oxides emitted during the burning of fossil fuels; (3) economic and ecological reality of forest destruction; (4) controlling emissions through requirements for effective technology; (5) international cooperation as an essential factor in controlling a wholesale continental pollution trade; and (6) the emerging realization of the potential economic and ecological consequences of acid rain and air pollution.

Wood, David, and Jeannette Bryant. Acid Rain: Activities for Grades 4 to 12. A Teacher's Guide. Washington, DC: National Wildlife Federation, 1983. ED 241 259. EDRS price: MF-$0.97 plus postage.

This teacher's guide on acid rain is divided into three study areas to explain: (1) what causes acid rain; (2) what problems acid rain has created; and (3) what teachers and students can do to help combat acid rain. Many of the activities are science experiments or investigations. Experiments involve learning about acidity, the water cycle, sources of acid rain pollution, air-borne particles, acid rain's effects on aquatic life and plant seedlings, and the buffering capacity of different types of soil. Other activities involve talking with people in the community, learning about the Clean Air Act, and writing letters to elected representatives. A crossword puzzle, a glossary, a bibliography of 17 journal articles, one filmstrip with cassette, one film, and one set of curriculum materials is included.

ACTIVITY 4: 30,000 BARRELS OF GOO

Baum, Rudy. "Project Designed to Educate Public on Chemicals Starts Up." Chemical and Engineering News 92(May 28 1984):29-30. EJ 301 875.

The Chemical Education for Public Understanding Project is a three-year pilot project designed to provide the public with accurate information on uses and hazards of chemicals, ranging from control of garden pests to types of toxic wastes generated by industry. Discussed are project aims and educational materials to be developed.

Beecher, John L., and Arthur J. Fossa. "The Problem of Toxic Wastes." Conservationist 34(March-April 1980):33-35. EJ 220 061. Reprint available from UMI.

Traced is the historical development of toxic waste problems in western New York State from 1825 to the present. Three major data sources are described: Industrial Chemical Survey, Inventory of Industrial Waste Generation Study, and the Interagency Task Force Study, which was developed by the Department of Environmental Conservation to prevent future problems.

Environmental Trends. Washington, DC: Council on Environmental Quality, 1981. ED 245 885. EDRS Price: MF-$5.65/PC-$42.40 plus postage.

This document consists of data which highlight trends in all sectors relevant to environmental policy. These data are presented in the form of charts and maps contained in 13 sections under the following headings: people and the land; critical areas (wetlands, wild areas, parks, historic places, and risk zones); human settlements; transportation; material use and toxic waste; toxic substances (pesticides, industrial chemicals, metals, and radiation); cropland, forests, and rangeland; wildlife; energy; water resources; water quality (rivers and streams, lakes, and oceans); air quality; and the biosphere (population, land, wildlife, oceans, and atmosphere). Each chart or map is accompanied by a brief discussion highlighting the changes noted. Among the findings reported are: (1) a reduction in total suspended particulates and sulfur dioxide concentrations in urban air; (2) a continual reduction in the extent of natural land areas in the United States; (3) a dramatic change in the patterns of land use in the United States (such as human settlements locating in areas once avoided because they were too hot or cold); and (4) changes in the condition of the land due to natural and/or human factors.

Freedberg, Louis. "Are We Poisoning the Places Where Children Play?" *PTA Today* 9(May 1984):14-16. EJ 298 875.

Public health is threatened by toxic wastes when recreational facilities are built over dump sites or abandoned industrial plants. This article discusses the problem of disposing of hazardous wastes and how it affects unknowing children and adults.

Goldman, Jill S., et al. *Investigations: Toxic Waste. A Science Curriculum in the Participation Series*. Cambridge, MA: Educators for Social Responsibility, 1984. ED 254 443. EDRS Price: MF-$0.97 plus postage.

One of a series of teacher-developed curriculum guides designed to encourage student participation and involvement in important social issues, this secondary level guide presents toxic waste as one example of a current issue requiring social action. The first section focuses on the skill of investigating as a means of introducing students to empirical methods, to the connection between science and social problems, and to an awareness of environmental issues. After completing readings on the biases of scientific studies and two case histories, student activities focus on identifying hazardous waste substances, finding out more about residential toxic waste, and exploring toxic waste treatment in their community. Lab activities deal with toxic waste and groundwater, testing soil and water, the effect of pH and salt on living organisms, and detection of heavy metals in water. Examples of active approaches to environmental problems are presented in the final section, in which students may read about Rachel Carson, whose writing was influential in arousing public concern over the dangers of pesticides; discuss a toxic waste treatment program implemented in Denmark; examine government decision making; participate in a mock congressional hearing on toxic waste; and create a research plan for investigation. A list of resources concludes the guide.

Panem, Sandra, ed. Public Policy, Science, and Environmental Risk. Brookings Dialogue on Public Policy. Washington, DC: Brookings Institution, 1983. ED 241 277. EDRS Price: MF-$0.97 plus postage.

This workshop explored the complex issues involved in scientific measurement of environmental risk. Specific purposes were to articulate policy issues that concern the use of scientific data in environmental risk assessment and to contribute to the dialogue from which better policy might emerge. Viewpoints of workshop participants from the executive and legislative branches of government, industry, the academic community, and the policy analysis community are provided under these titles: "Differences in Assessing Risks for Food and Drugs," "Risk Assessment and the Legislative Process," "Science and Environmental Risk: Policy Issues," "Regulating Toxic Substances: An Update," "New Scientific Issues," "The Clean Air Act: An Update," "Etiological Factors in Human Cancer," "Future Directions for Science and Policy," "Risk Analysis at the Office of Technology Assessment," and "Industrial Perspective on Regulating Carcinogens." Among the broad areas of consensus reported are those indicating that federal regulations are needed (especially in regulating chemical substances that affect human health) and that there is rarely an effective dialogue between industry and government before issues become critical and debate assumes a confrontational character.

Pfortner, Ray. "The Control of Hazardous Wastes and the Role of Environmental Educators." Nature Study 37(March 1984):43-44. EJ 300 316. Reprint available from UMI.

Discussed is legislation aimed at hazardous waste issues which are implemented by the Environmental Protection Agency and state governments. Particular attention is given to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). A case study of an abandoned superfund site is included with two related student assignments.

State of the Environment: An Assessment at Mid-Decade. Washington, DC: The Conservation Foundation, 1984. ED 247 141. EDRS Price: MF-$5.65 plus postage.

This report is divided into two parts. The three chapters in part 1 describe environmental conditions and trends. Chapter 1 deals with underlying trends--primarily population growth and economic factors. Chapter 2 covers environmental contaminants, including toxic substances, hazardous waste, air and water pollutants, and overall waste production. Chapter 3 deals primarily with natural resources, examining water, land (including cropland, forestland, rangeland, wildlands, and critical areas), wildlife, energy, and recreation. The five chapters in part 2 analyze several long-range issues that cut across the traditional categories used to describe environmental problems. Chapter 4 reports on several studies that have tried to identify future environmental problems and discusses the factors that are relevant for establishing priorities among these problems. Chapter 5 explains the methodology used in assessing environmental risks, focusing primarily on the analysis of chemicals in the environment. Chapter 6 analyzes the extent to which toxic substances move from air to water to land and the policy implications of such movement. Chapter 7 covers water quality and water quantity problems, the interrelationships between them, and issues related to the management of this vital resource. Chapter 8 explores the relationship between the federal government and the states in implementing environmental policies.

"Toxic Substance in the Environment." Cleaning: Nature and Learning in the Pacific Northwest 33(September 1894):4-9. EJ 307 520.

This article discusses the nature of toxic substances, examining pesticides and herbicides, heavy metals, industrial chemicals, and household substances. Included is a list of major toxic substances (indicating what they are, where they are found, and health concerns) and a student activity on how pesticides enter the food chain.

ACTIVITY 5: MINING THE SEABED

Earney, Fillmore C. F. "Law of the Sea, Resource Use, and International Understanding." Journal of Geography 84(May-June 1984):105-110. EJ 319 066. Reprint available from UMI.

An account of the evolution of the United Nations Convention on the Law of the Sea, which set aside a major portion of the world's oceans as a common heritage of mankind, is presented. An examination of the convention's precepts illustrates discussion questions for use with secondary or college students.

Hudson, Richard. "The International Struggle for a Law of the Sea." Bulletin of Atomic Scientists 33(December 1977):10, 14-20. EJ 172 542. Reprint available from UMI.

This article discusses advantages and disadvantages of an international law of the sea.

Levy, Jean-Pierre. "The Law of the Sea." International Understanding at School 33(1978):14-18. EJ 178 540. Reprint available from UMI.

Recounted are problems related to the law of the sea and suggestions that these problems could be dealt with in the classroom in an interdisciplinary manner. Problems include pollution control, fishing rights, development of deep sea mineral deposits, and shore access.

Osgood, Robert E., et al. *Toward a National Ocean Policy, 1976 and Beyond*. Washington, DC: John Hopkins University School of Advanced International Studies, 1976. ED 134 418. EDRS Price: MF-$0.97/PC-$16.15 plus postage.

Each chapter in this publication takes up a specific issue, analyzes the issues important to the United States, discusses its evolution in the international negotiating process, and considers the various policy options in the context of the treaty-making exercise. The criteria for evaluating policy options are included. The eight chapters are: (1) The Evolving International Ocean Regime, (2) The Third U.N. Conference on the Law of the Sea, (3) National Security, (4) Commercial Navigation, (5) Marine Environment, (6) Fisheries, (7) Mineral Resources, and (8) Marine Science. The appendices include a chart of legal and geographic definitions, a glossary, a list of selected events, and a selected bibliography.

Richardson, Robin. "Learning in a World of Change: Methods and Approaches in the Classroom." *Prospects: Quarterly Review of Education* 9(1979):184-196. EJ 207 141.

This article recommends that teachers use a curriculum development project (The World Studies Project) to help students increase their understanding of global affairs such as human rights, economic order, disarmament, the world environment, and the law of the sea. Activities and objectives of the project are presented, and ordering information for additional project activities and publications is included.